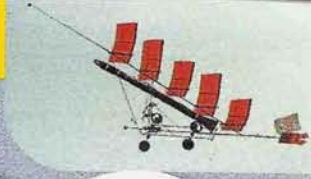
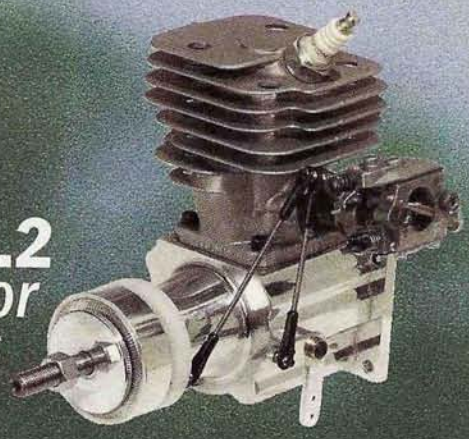
HE WILDEST RC FLYING MACHINES YOU'LL EVER SEE p. 44



MODEL Airplane NEWS

GET into SCALE
the easy way
page 32

EVIEWS
Dave's Aircraft Works park flyer
Yellow Aircraft F/A-18
Great Planes Giles
R 10X radio



FOX 3.2
All-American motor maker goes gas

OVER 50 FLOATS
which ones to buy
how to use them

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MODEL Airplane NEWS

SEPTEMBER 2000 • VOLUME 128, NUMBER 9

ON THE COVER: the MRC/Altech EZ Zero makes a low pass for the camera; see Chris Chianelli's review of this scale ARF on page 32. Insets: Peter Haas's flying clarinet was just one of the fantastic models at the Inter-Ex Fly-In (top); Vic Olivett and Bill Steffes review the 3.2, the first gas-burner from Fox Mfg. (left); learn everything you need to know about flying off water in Jim Onorato's "A Guide to Flying with Floats" on page 26.


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Departments

EDITORIAL
BY DEBRA SHARP

RC Aeronomalies

Have you ever seen an RC lampshade? How about a flying clarinet? Outlandish and unusual electric-powered RC models are commonplace at the annual Inter-Ex Fly-In in the Netherlands, where innovative, creative modelers gather to put on a one-of-a-kind RC show. *Model Airplane News* overseas reporter Guy Revel attended this past year's festivities and shares his photos and story on page 44. Guy also gives us the scoop on "Truefly," which might be the world's first successful, amateur-built RC ornithopter. This ingenious design has rigid wings (like those of conventional RC planes), and it derives all of its propulsion and lift from flapping them as a bird would. If this article inspires you to experiment with your own RC "oddity," please take a photo of it and send it to us at *Model Airplane News* so that we can share it with the rest of our readers.

Two of the ornithopters at the Inter-Ex Fly-In. "Truefly" is on the right.

FLYING ON FLOATS

Q: what beats RC flying all day at the field on a beautiful summer day? A: flying at the pond! Nearly any RC plane can be outfitted with floats, and veteran model builder and flier Jim Onorato shows you how easy it is to use a pond or a lake as a flying field in this month's "Guide to Flying with Floats." This article tells you how to choose the right plane to equip with floats, covers basic float construction, setup and rigging and offers tips for flying off water.

We've also included a guide to commercially available floats and a list of float-fly events and meets for you to mark on your calendar.

FROM JETS TO MICRO-FLYERS

In this issue, we offer Field and Bench reviews of a detailed, prefabricated ducted-fan jet; an incredibly scale ARF with retracts; a midsize, built-up aerobat and an indoor/outdoor park flyer. In his review of the Yellow Aircraft F/A-18 Hornet, Bob Boswell shares his experiences building the highly detailed, fiberglass and foam model. Next, Chris Chianelli shows just how easy it can be to get into scale with his MRC/Altech EZ Zero, a high-quality ARF that comes with scale markings, rivet and panel-line detail and even weathering. Those of you who like to spend a little more time in the shop will appreciate Keith Palmer's insights into building the Great Planes Giles G-202, a 60-inch-span aerobat that features tab-and-slot construction. Last but not least, Dave Garwood builds a Dave's Aircraft Works PF-5 electric park flyer and then teaches his wife to fly RC at an indoor ice arena.

Whether it's off-beat, off-the-water, or indoors, there are more ways to enjoy RC airplanes than ever before. ✈

Nothing beats touch-and-go's on the water with a Piper Cub.

MODEL Airplane NEWS

FOUNDED 1929

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Member Audit Bureau of Circulations

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AIRWAVES

Our readers write back

WRITE TO US! We welcome your comments and suggestions. Letters should be addressed to "Airwaves," *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606 USA; email man@airage.com. Letters may be edited for clarity and brevity. We regret that, owing to the tremendous numbers of letters we receive, we can not respond to every one.

PROPS AND PERFORMANCE

I read the July article by Chianelli and Gierke with great interest. I've struggled with this issue for some years and now better appreciate the "prop for airframe" philosophy. In the past, I've always used the standard recommendation and have not tuned the combination; now, though, I thought I'd give this a try.

I recently upgraded my Tower 60 Kaos from an old and tired O.S. 60FP to an O.S. 91FX. After handling the ground-clearance issues, I've begun experimenting with prop sizes. I want the vertical performance and slow landing speed. Thanks in advance for your help. [email]

TIM WILKERSON

Tim, after the engine has a bit of break-in time, I would start with either a 13x6 or 13x7, depending on prop type and manufacturer. Since the Kaos is a fairly clean design, even with no retracts, you could try a more deeply pitched 12-inch-diameter prop. You might try a 9- or 10-inch pitch or even an APC 12x11 prop. If, however, you want to keep landing speeds lower, stick with the 13-inch diameter; the greater "disc effect" will give you better low speed and aerobatic down-leg braking.

CC

TAME THE TAIL-DRAGGER

I found very interesting the article by Gerry Yarrish regarding tail-draggers. I have only one of these birds, but in the past, I built three different ones (Pigeon, Citabria and Extra 325), but I was not too happy with the results; even though they flew very well, they were very hard to take off, as the steering was really crazy when increasing speed and turning strongly to the right or the left. I eventually gave them away or sold them. Actually, I have a Kwikfly from a Graupner kit and have no problems when taking off, but I will make some modifications according to the article.

FEDERICO CAMPOS
New York, NY

Glad you enjoyed the article. One way to make takeoffs a bit easier is to apply throttle slowly and feed in rudder as needed, then neutralize the rudder again. Good luck; have fun.

GY

GOOD SECOND PLANE?

Just wondering if you could help me. I am keen to start building another plane while I'm learning to fly my trainer, but I am unsure which type of plane I should be looking for. What do you consider to be a good second plane? Sport, scale, biplane, etc. I have looked around a bit on the Internet, but the number of planes available there is overwhelming for somebody like me.

I read your review of the Giles 17.5 percent, and it sounded as though it would be a good next step. It sounded like it would be fun to fly; I would like to try some aerobatics when I am confident and capable. Also, it's in my price range. Your advice would be most appreciated. [email]

DEAN

Dean, I recommend that you go through two aileron trainers. You did not say whether your current trainer has ailerons; I assume it does. If you feel confident enough to want to go to a low-wing intermediate plane, I suggest you graduate to something larger than a 46-inch-wingspan 17.5 percent Giles as your second plane. Because of their more favorable Reynolds numbers, larger models react much more smoothly and slowly than smaller planes. Models fly much more "on the wing," as the expression goes, when their wingspans approach the 6-foot mark. A great example would be the Great Planes 72-inch-wingspan Space Walker. It has a big, constant-chord wing with a thick airfoil and reacts like a low-wing trainer with the controls set up at minimum throw. If you love aerobatic types, there are many CAP Extras and Giles in the high-60- to low-70-inch-wingspan range that also have docile flying characteristics if the weight is kept low and control-surface throws are kept to a minimum. Still, I would go with a second high-wing trainer or at least a constant-chord low-wing intermediate for my second choice, if I were you; no biplanes just yet.

Whatever you decide, have fun and fly safely. That's the most important thing. CC

GLOBAL ULTIMATE

I have purchased a Global Ultimate biplane, and I put a .91 4-stroke engine on it. Other than the weight I have to add to the tail, do you see any problems with flying the model with this particular engine, i.e., takeoff and typical all-around flight? Which prop would you use?

JAMES C. MATHIS

There won't be any problems when you fly the model with the .91; all you'll have to do is manage the throttle input so you're not flying the plane with the engine wide open all the time—and no downhill dives at full throttle, either.

You shouldn't have to add any weight to the tail. The one I built balanced perfectly with the servos placed per the instructions and the battery pack and receiver located aft of the servos (see the June 2000 issue of Model Airplane News, *page 48). Try a 14x6 or 13x10 propeller, and for the flight performance, see the article on page 51 of that issue. My model flies very well. Good luck.* RP

New products or people behind the scenes: my sources have been put on alert to get the scoop! In this column, you'll find new things that will at times cause consternation, and telepathic insults will probably be launched in my general direction! But who cares? It's you the reader who matters most! I spy for those who fly!

AIR SCOOP

BY CHRIS CHIANELLI

ZENOAH

GT-80

For the many Zenoah fans out there, I'm happy to let you in on news of the introduction of the largest displacement engine the company has offered yet. Its new GT-80 twin is based on the powerful GT-74 (old Z-445) twin. The 80 features an increased bore diameter that yields an increase in displacement of 6cc. Dual rings on each piston give a superior seal, while the self-contained quartz ignition gives a reliable spark without the hassles of charging ignition batteries. A spring starter is rear mounted.

Also shown is Zenoah oil, blended specifically for model aircraft spark-ignition engines; Zenoah claims that it reduces friction, fights heat and is ultra-clean burning with low carbon build-up.

Horizon Hobby Inc., 4105 Fieldstone Rd., Champaign, IL 61822; (217) 352-1958, ext. 230; (217) 352-2010.

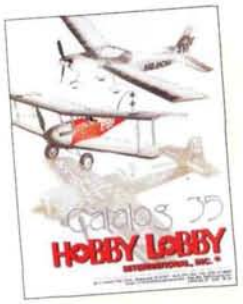
The Ryan STA is, without a doubt, an icon of aviation's historic "Golden Age." Great Planes pays tribute to this beautiful and significant design by offering it to us in ARF form for 1.20-size 4-stroke engines. This is an all-wood, MonoKote-covered, built-up ARF that, according to Great Planes Model Distributor's president and founder, Don Anderson, "... looks and flies like an exceptionally well-built kit." In an effort to set the Ryan apart from other ARFs, Great Planes has paid close attention to finer scale points such as cockpit detailing, cowl ducting and blister detail. Fiberglass wheel pants and cowl are painted in three colors to match the Ryan's color scheme. Specs: wingspan—80 inches; wing area—1,002 square inches; weight—10.3 pounds; wing loading—23.5 ounces per square foot; engine required—.61 to .91 2-stroke, or .91 to 1.20 4-stroke.

Great Planes Model Distributors Co., P.O. Box 9021, Champaign, IL 61826-9021; (800) 682-8948; fax (217) 398-0008; www.greatplanes.com.

Ready-to-cover 202

The latest from R/C America is this IMAA-legal ARC (almost-ready-to-cover) Giles G-202. Like other designs form R/C America, the 202 comes completely built up and sanded, ready for your choice of covering. The kit features a two-piece, plug-in wing; aerodynamically shaped tail surfaces; fiberglass cowl and wheel pants; aluminum landing gear; tailwheel wire and control-horn hard-points. The 202 has an 80-inch wingspan, weighs between 14 and 16 pounds and is recommended to be powered by 1.8 to 2.1ci glow power, or 2.6 to 3.7ci gas/ignition engines.

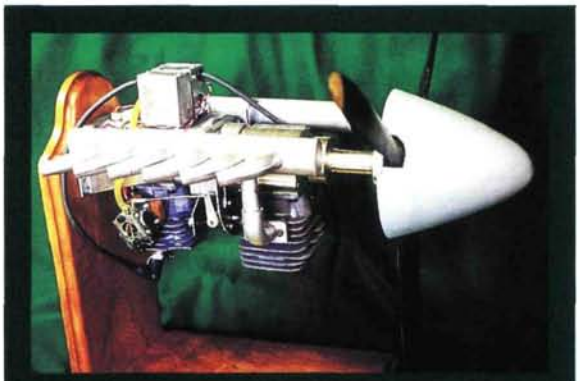
R/C America also has two other 80-inch-wingspan ARC models: a CAP 232 and an Extra 300S. For more information and prices, contact your hobby shop or call R/C America at (217) 359-5116.



Backyard Barnstormer

Popular with seasoned modelers because they're so convenient, park flyers and slow flyers are also turning on a lot of new people to the world of RC airplanes—people who don't care to join a club (or don't have one nearby), and people who just want to fly in an open area near their home. And what looks more natural buzzing backyard trees and softball backstops than a blue and yellow Army Air Force PT-17 trainer? Hobby Lobby's Stearman has a 34-inch wingspan and features ready-built parts that come already painted. The model includes a 4.5:1 gearbox and is rumored to be a good flyer. If you'd like to browse pages of "fly-at-home" models, order Hobby Lobby's new catalog; it's loaded with cool small models and micro equipment.

Hobby Lobby Intl., 5614 Franklin Pike Cir., Brentwood, TN 37027; (615) 373-1444; fax (615) 377-6948.



Classic Configurations

The Clark Merlin-II twin has an exhaust configuration for the P-51D Mustang but is also available for the Spitfire MK VI, IX, XII, XVI and Hawker Hurricane scale exhaust. This engine was developed using the Sachs-Makita 3.2ci (52cc) crankshaft, cylinder assemblies and custom CNC-machined crankcase and features electronically advanced solid-state ignition. The Merlin claims more than 6,000rpm on a 26-inch, 3-blade prop. It's 13½ inches long and weighs 13 pounds.

The single-cylinder Clark Gypsy Minor 31cc is a Ryobi conversion that features a cantilevered crankshaft; two radial thrust bearings; a connecting rod with needle bearings at both ends and a nicasil-lined cylinder. The engine is supplied with motor mounts, a Bisson muffler and a choke cable and is ideal for narrowly cowled aircraft such as the Tiger Moth, Percival Mew Gull and other in-line engine aircraft.

Clark Industries Inc., RR 4, Tottenham, Ontario, Canada LOG 1WO; phone/fax (905) 936-2131.

The Baddest FX Yet!

Pictured here with O.S.'s smallest 2-stroke engine, the LA .10, the new O.S. 1.60 is the largest in the popular FX line of aircraft engines that boasts many performance features in a traditional compact design for sport and scale applications. This powerplant comes with a remote needle that can be mounted three ways: vertically, horizontally, or completely separate from the engine. It's engineered for low fuel consumption with a wide power band, with intake and exhaust-port timing that boosts higher torque at lower rpm. The 1.60 FX can be flown on FAI fuel and glow fuels with up to 25 percent nitro content and includes a ⅜-24-size safety locknut and smaller prop nut to fit APC propellers. The easily adjustable Type 60F carburetor offers good throttle response while the included E-5010 silencer contributes to quieter flights.

Specifications: displacement—1.60ci (26cc); bore—1.32 inches (33.6mm); stroke—1.16 inches (29.6mm); practical rpm—1,800 to 10,000; output—3.7hp at 9,000rpm; weight—32.6 ounces (925g).

Great Planes Model Distributors Co., P.O. Box 9021, Champaign, IL 61826-9021; (800) 682-8948; fax (217) 398-0008; www.greatplanes.com.

Flyboy-1 ARF

The sleek Flyboy is not a primary trainer; rather, it is a fully aerobatic design with a symmetrical airfoil that is perfect as a second or third choice for the intermediate pilot. Flyboy comes completely built, covered and painted, and it features a fiberglass fuselage with matching painted fiberglass cowl and plastic spinner. The wing is covered with heat-shrink film, as is the tail group. The kit includes an engine mount, fuel tank, wheels, control linkage and hardware. According to its manufacturer, D&L Designs, Flyboy can be ready to fly in 5 hours. Specs: wingspan—48.75 inches; wing area—410 square inches; weight—less than 4 pounds; engine required—.25 to .40 2-stroke; radio required—4-channel.

D&L Designs, 1145 E. Kleindale Rd., Tucson, AZ 58719; (520) 887-0771.

The Baron's own ARF

Global goes back in time to aviation's early days with a .40-size Fokker D-VII ARF.

The Fokker is simple to build, and according to Global, it flies great. In fact, it has been reported that this model flies like a docile sport design; it has a wide speed range and a light wing loading of 16.9 to 20 ounces per square foot. And, yes; it comes with those spoked wheels. The kit features all-wood, built-up construction; a painted fiberglass cowl; vacuum-formed machine gun; adjustable aluminum cabane struts and covered wooden interplane N-struts. Specs: top wingspan and area—48.5 inches and 388 square inches; lower wingspan and area—43 inches and 354.75 square inches; weight—5.5 to 6.5 pounds; power required—.40 to .46 2-stroke, .52 4-stroke, or AstroFlight 25G/18C for electric power.

Global Hobby Distributors, 18480 Bandilier Cir., Fountain Valley, CA 92728-8610; (714) 963-0133; fax (714) 962-6452.

PILOT PROJECTS

A look at what our readers are doing

SEND IN YOUR SNAPSHOTS. ***Model Airplane News*** **is your magazine and, as always, we encourage reader participation. In "Pilot Projects," we feature pictures from you—our readers. Both color slides and color prints are acceptable. We receive so many photographs that we are unable to return them.**

All photos used in this section will be eligible for a grand prize of $500, to be awarded at the end of the year. The winner will be chosen from all entries published, so get a photo or two, plus a brief description, and send them in!

Send those pictures to: Pilot Projects, *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606 USA.

SHOW-WINNING SIKORSKY

If you had the chance to attend the WRAM show this year, no doubt the first-place Civilian 1/6-scale Sikorsky flying boat caught your eye. The model, built by Classic Aero owner Allen Mrock of Oxford, MI, is based on a full-scale replica of the original S-38 amphibian.

TOP GUN TRAINEE

This P-51B is an old Top Flite kit built by 13-year-old Kyle Lord of Colchester, CT. Kyle bought the kit at an auction and installed the B+D retracts with minimal help from his father, Dana; otherwise, he built the plane on his own. The Mustang has an O.S. FP .60 for power and an Airtronics Vanguard 6-channel onboard. We understand that Kyle is quite talented with a covering iron (he covers Dad's planes, too!) and that he hopes to compete in Top Gun someday. With his obvious talent, dedication and ambition, it won't be long!

MINI FORTRESS

Bomber Field in Monaville, TX, sees many of the country's largest multi-engine warbirds; now, this B-17G takes things to the opposite extreme. Cypress, TX, modeler Ray Mead, with the much-appreciated assistance of many, built this Guillows kit in just 4½ months as an RC conversion with four Graupner speed 280s for power. The flying weight is 37½ ounces thanks to the lightweight Hitec radio gear. Ray presently has a Guillows B-29 on the workbench; regardless whether he ever flies it, he'll be pleased just to listen to the motors hum and taxi it around.

BEECH NUT

This Top Flite Beech Bonanza is the latest project by Bob Tomasulo of Palatine, IL. The meticulously detailed scale project took 18 months and features nearly 2,000 rivets, Robart landing gear and Fiberglass Specialties cowl, tail cone and cockpit top. Bob installed a full interior kit, functional lighting and a JHM onboard glow system to top off his efforts. A Futaba 8-channel radio with FMA servos guides this beauty.

CATCH OF THE DAY

Sturgeon Lake, MN, sounds like an ideal hometown for float flying. Todd Booker sent in this shot of his unique Carl Goldberg Eagle 2; it's outfitted with floats and an O.S. .46FX engine. The art credit goes to Todd's mother-in-law, Francie Skarich, who brush-painted the seaplane.

WORLD WAR WONDER

George Moberg of Bonita, CA, built this 1/4-scale Flair Fokker DR1, and to surprise him, his wife, Mary, sent us a picture of it. The model has a 73-inch span and a US 35 engine under the cowl. George finished the triplane with 21st Century fabric and controls the warbird with his Airtronics Radiant. According to Mary, the total assembly time was "... one year of Saturdays to build plus approximately 20 football and baseball games to cover."

CONVERTED IN COLORADO

Andy Simmering of Loveland, CO, made this wonderfully detailed L-4 out of his Balsa USA Cub kit. The Coverite fabric is enhanced with F&M pinking tape, simulated automotive paint and hand-applied graphic, all topped off with matte clear. The model has a fully detailed cockpit as well as Andy's own handmade landing gear. Future plans are to swap the plane's G-23 for a 4-stroke twin engine.

TIP YOUR CAP

From Brazil comes this Lanier Cap 232 built by Marcelo Assis in just three months. The aerobatic 80-inch plane is powered by a G-62 and has a MonoKote Aeroshell trim scheme. Marcelo chose a Hangar 9 pilot and instrument panel for added realism, and he says that the Cap is an excellent flyer that performs all possible maneuvers.

LONES' LIBERTY

Bill Lones of Knoxville, TN, sent this photo of his Sig Liberty Sport. The model is covered with 21st Century fabric and has an O.S. 91 4-stroke for power. Bill controls this good-looking biplane with a JR radio system.

EARNHARDT FAN-TOM

Domenick Grillo of Staten Island, NY, doesn't plan to enter his jet in any scale contests, so when it came time to finish his scratch-built Ziroli F4, he chose the color scheme of his favorite NASCAR driver: Dale Earnhardt. The Winston Cup warbird has an O.S. 46DF mated to a Kress RK 740 fan unit.

HINTS & KINKS

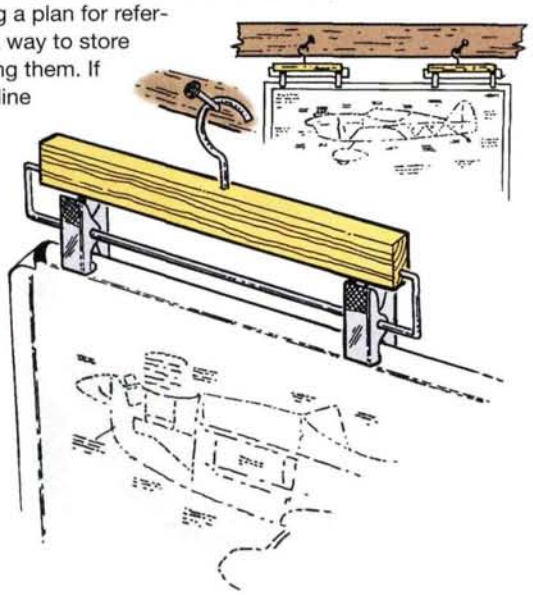
BY JIM NEWMAN

SEND IN YOUR IDEAS. *Model Airplane News* will give a free one-year subscription (or one-year renewal, if you already subscribe) for each idea used in "Hints & Kinks." Send a rough sketch to Jim Newman c/o *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606 USA. BE SURE YOUR NAME AND ADDRESS ARE CLEARLY PRINTED ON EACH SKETCH, PHOTO AND NOTE YOU SUBMIT. Because of the number of ideas we receive, we can't acknowledge each one, nor can we return unused material.

SLACK TIMES

Two slacks or skirt hangers, hooked over nails, are quite suitable for hanging a plan for reference. This is also a way to store plans without folding them. If the plans are blue-line Ozalid process prints, attach a black plastic cover sheet back and front to minimize fading.

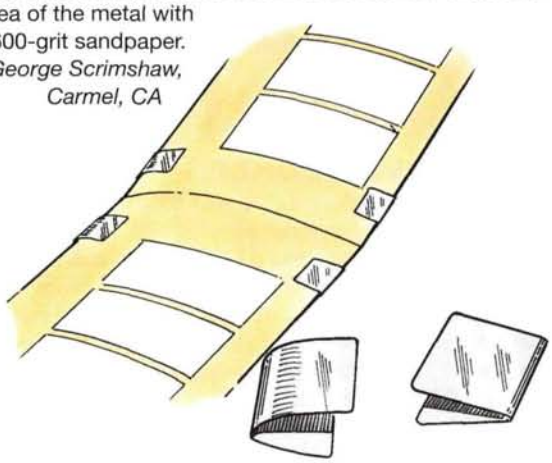
Dennis Bryant, Burgess Hill, Sussex, England



PROTECTION IN A CAN

Rectangles of thin metal cut from soft drink cans, formed to fit, then glued to leading and trailing edges will protect the balsa from being crushed by the hold-down rubber bands. Clean the gluing area of the metal with 400- or 600-grit sandpaper.

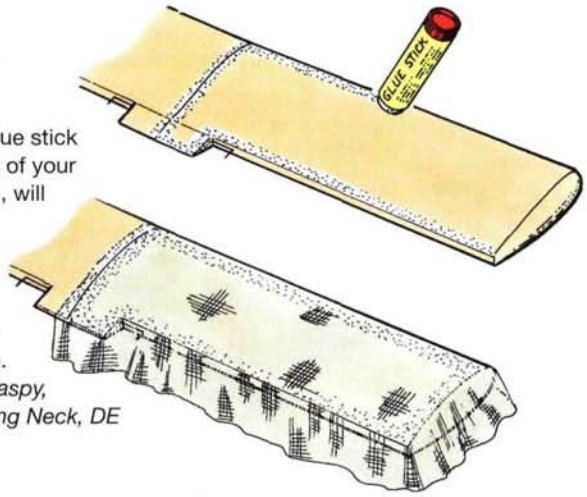
George Scrimshaw, Carmel, CA



NO MESSY SPRAY

A thin smear of glue stick around the edges of your wing and tail, etc., will lightly hold your glass cloth as you straighten the weave and pull it taut before applying the resin.

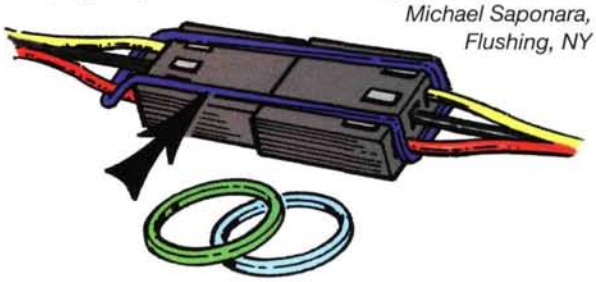
Dawson Gillaspy, Long Neck, DE



BAND TOGETHER

Pick up a few tiny rubber bands from the hair-care counter. They are very useful for slipping over servo plugs to prevent them from coming apart.

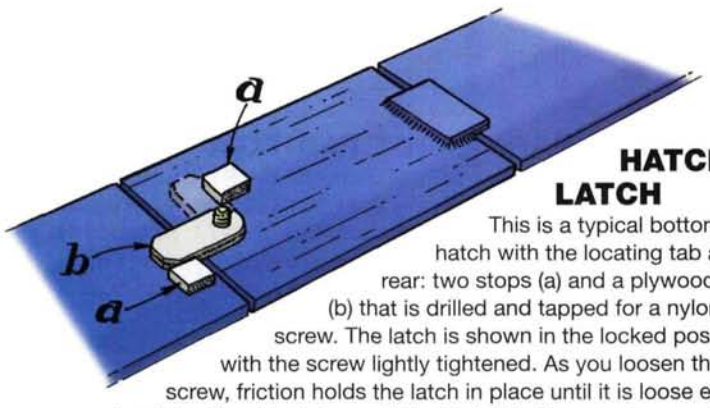
Michael Saponara, Flushing, NY



THE NUMBERS GAME

Here's a way to be sure you pick up the transmitter that matches your model. Apply press-on numbers from an office-supplies store to each of your models. The numbers must match the transmitter channel number and can look like racing numbers or glider competitor numbers.

Don White, Houston, TX



HATCH LATCH

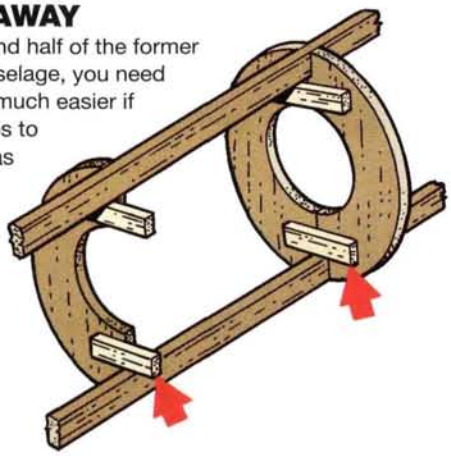
This is a typical bottom hatch with the locating tab at the rear: two stops (a) and a plywood latch (b) that is drilled and tapped for a nylon screw. The latch is shown in the locked position with the screw lightly tightened. As you loosen the screw, friction holds the latch in place until it is loose enough to rotate, then it rotates until the latch hits the rear stop, and this allows the hatch to be removed.

Mike Hausner, Churchville, NY

ALL SQUARED AWAY

Before you add the second half of the former to this type of built-up fuselage, you need to align the parts; this is much easier if you glue short balsa strips to the face of the first half, as shown by the arrows.

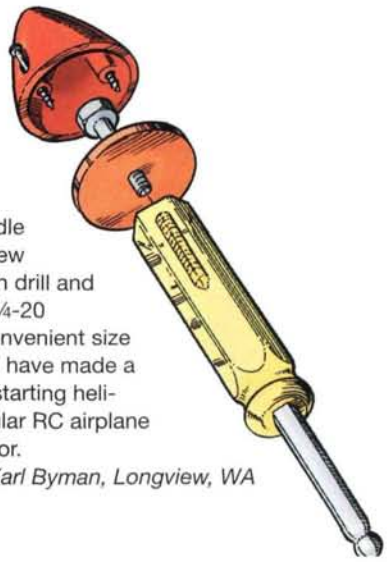
Tom Esposito, Lisle, Il



'COPTER STARTER

Square off the handle of a 6mm Allen screw ball-end driver, then drill and tap the handle for ¼-20 thread. Attach a convenient size of spinner, and you have made a useful adapter for starting helicopters with a regular RC airplane electric starter motor.

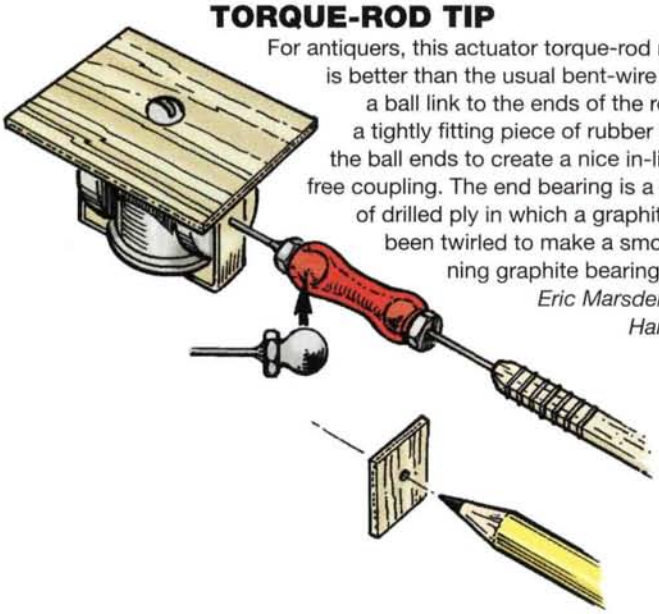
Karl Byman, Longview, WA



TORQUE-ROD TIP

For antiquers, this actuator torque-rod modification is better than the usual bent-wire link. Solder a ball link to the ends of the rod, then slip a tightly fitting piece of rubber fuel line over the ball ends to create a nice in-line, friction-free coupling. The end bearing is a small square of drilled ply in which a graphite pencil has been twirled to make a smoothly running graphite bearing.

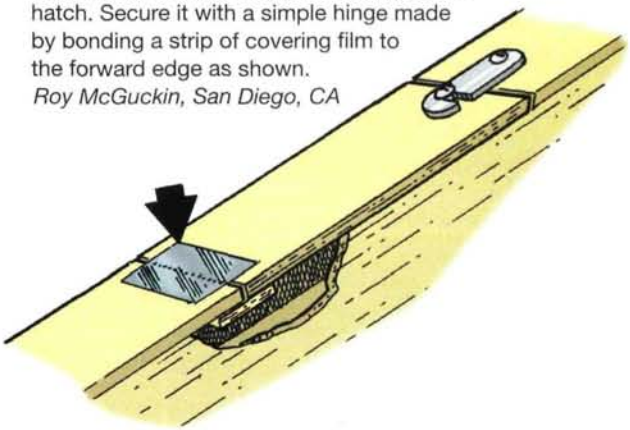
Eric Marsden, Horndean, Hants., England



CAPTURED HATCH

If the latch loosens in flight, you will lose the hatch. Secure it with a simple hinge made by bonding a strip of covering film to the forward edge as shown.

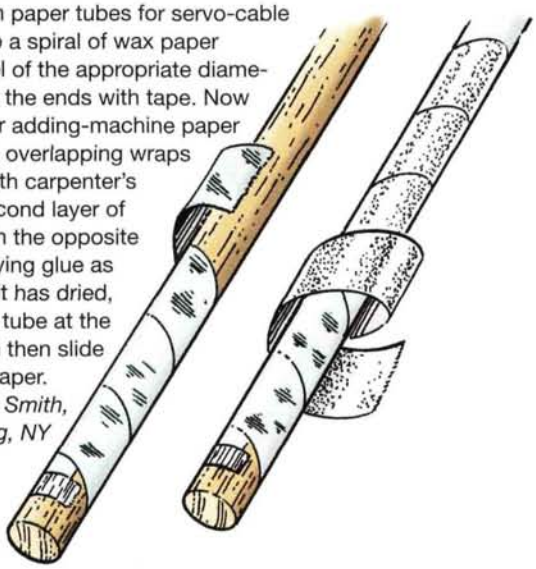
Roy McGuckin, San Diego, CA



PAPER BOY

Make your own paper tubes for servo-cable conduits. Wrap a spiral of wax paper around a dowel of the appropriate diameter, and secure the ends with tape. Now wind on regular adding-machine paper and secure the overlapping wraps with full-strength carpenter's glue. Add a second layer of paper wound in the opposite direction, applying glue as you go. When it has dried, cut around the tube at the required length then slide it off the wax paper.

Carlton Smith, Trumansburg, NY



REFILLABLE BRUSH

Screw a binder clip to the end of a large-diameter dowel, then clamp foam between the jaws to make a refillable foam brush. To change paint colors, just put in new foam.

Jay Wallace, Ashland, OR

A GUIDE TO

FLYING WITH FLOATS

by Jim Onorato

Get your feet wet and start having fun on the water!

One of my most memorable RC moments (second only to my first solo flight) was the first time I flew off water. The plane was a Sig clipped-wing Cub powered by an Enya .46 4-stroke and outfitted with a pair of 30-inch Balsa USA floats. To say I was nervous would be a gross understatement. Fortunately, all went well, and apprehension proved to be for naught. That was 13 years ago, and I still look forward to springtime when my boat goes back into the water and the floatplanes get dusted off for another enjoyable season on the lake. As a matter of fact, I don't think I've ever taken the floats off of that Cub! It's usually the first one out each spring, and the exhilaration I get from that first water liftoff never seems to fade. I hope this article will inspire other RC'ers to try this exciting aspect of our hobby.

So just which kinds of airplanes can you put on floats?—just about any, I suspect, but some are better candidates than others. My favorite is the high-wing cabin-type such as a Cub or another tail-dragger. But hey; I've even seen a DC 3 on floats! The possibilities are endless. Compared with low-wing types, high-wing models look realistic on floats and they are much less susceptible to water getting in at the wing saddle. They are also easier to adapt to floats because their main landing gear can often serve as the front strut for the floats.

Scale, sport, military and even a fun-flying Clancy Lazy Bee can be flown off the water!

PHOTOS BY WALTER SIDAS

FLOAT TYPES

A variety of commercially available floats are available in several sizes, and at least four different construction materials are used in their manufacture.

These include:

- Conventional wooden kits that are built with lite-ply and balsa.
- Precut foam-cores that must be covered with 1/64-inch ply or a somewhat thicker sheet balsa.
- Ready-made molded-plastic floats.
- Ready-made fiberglass floats.

Wooden floats can be covered with heat-shrink film or with fiberglass cloth and resin and then painted. The ready-made plastic or fiberglass floats are usually painted but can be left as is. The choice of floats really depends on how much work you want to do and how much you want to spend on floats.

Left: nothing looks more at home on a pair of floats than a Piper J-3 Cub. This Great Planes Cub sits on a set of built-up wooden floats covered with fiberglass and painted. Simple wire struts and a single water rudder complete the picture. Center: another Cub; this .40-size J-3 rests on a pair of foam floats that have been covered with 1/64-inch plywood and sealed with resin. This setup has twin water rudders. Right: the Sig 1/6-scale clipped-wing Cub is shown here with Balsa USA wooden floats. Plywood plates reinforce the strut attachment points on top of the floats.

A typical balsa-and-ply float is built upside-down on the building board in much the same way as you'd build a fuselage. Lite-ply formers and stringers make up the framework that is then sheeted with balsa or thin plywood. Lite-ply doublers are usually installed at the strut mounting points. In some cases, a hardwood spine runs the length of the float and allows the strut mounts to be located anywhere along the length of the float. This really simplifies matters when it comes to "hanging" the floats on your model.

Floats may have flat bottoms or vee bottoms. Vee-bottom floats track better but are less maneuverable and also produce more spray than flat-bottom floats. Flat-bottom floats are easier to build, but they don't look nearly as good as the more scale vee types.

INSTALLATION

When outfitting a plane with floats, the biggest challenge is in the placement and attachment of the floats to the fuselage. On many planes, the forward strut is attached to the fuselage just forward of the wing's LE, and the rear strut is attached to the fuselage just aft of the wing's TE. In any event, the fuselage must be reinforced at these attachment points. A piece of 1/8-inch aircraft plywood installed under a former and strengthened with gussets will usually be sufficient. Unless you buy a kit that comes with floats specifically designed for your plane or you buy floats designed for a specific airplane, you are pretty much on your own when it comes to attaching them. For most models, float struts have to be custom made, and on all but scale models, they are usually made with steel music wire of various sizes.

On smaller planes—up to .40 size—formed-aluminum or molded-fiberglass landing gear can be used for the struts. This works best if the bottom of the fuselage is parallel to the model's datum line so the struts are the same length. If the struts have to be different, the chance of finding the exact size for the rear strut is usually pretty slim. If you use formed gear, they will usually be rigid enough to eliminate the need for diagonal bracing. Of course, you could make the rear strut out of steel wire, but that would look a little odd.

SETUP RULES

Several basic guidelines should be followed when considering the size and position of floats relative to a model's fuselage:

- **The floats' length should be between 75 and 80 percent of the length of the fuselage (measured from the engine's thrust washer to the rudder hinge line).**
- **The plane's center of gravity should be at or slightly forward of the float's step.**
- **The floats' tips should extend at least 2 inches in front of the propeller.**
- **There should be at least 2 inches of clearance between the tops of the floats and the tip of the propeller.**
- **The floats should be set parallel to the plane's datum line or with 1½ degrees of negative incidence.**
- **The centerline distance between the floats should be between 20 and 25 percent of the model's wingspan.**

Floatplane setup

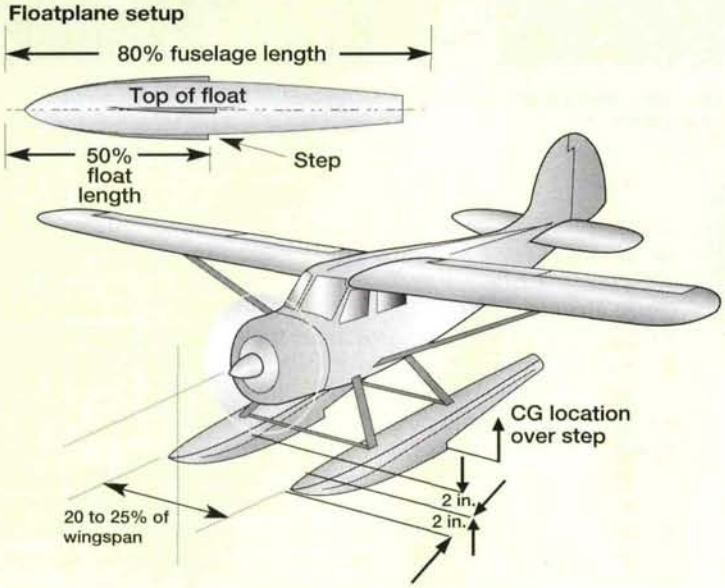
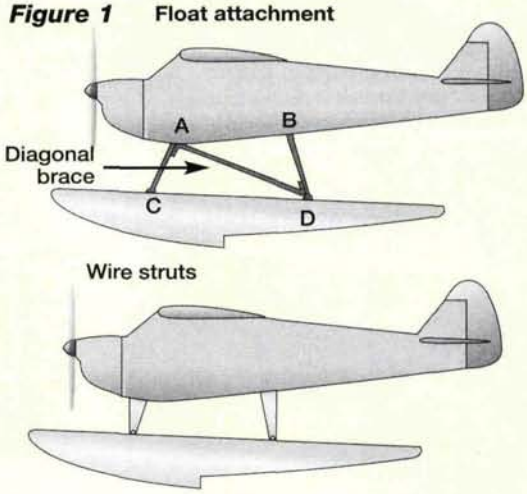
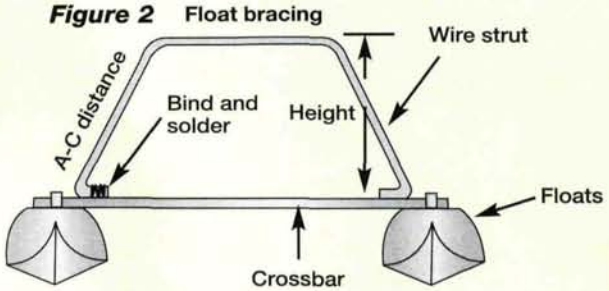


Figure 1 **Float attachment**



Formed-aluminum or fiberglass landing-gear struts don't require diagonal bracing.

Figure 2 **Float bracing**



Typical wire strut with crossbar brace forming a trapezoid

If all this seems confusing, not to worry: there is a relatively straightforward procedure that gives good results every time. But first, I'll cover a few basics to make this a little easier to follow.

In Figure 1, the point where the front strut is attached to the fuselage is point A. Point B is where the rear strut is attached to the fuselage. Points C and D are where the front and rear struts (respectively) are attached to the floats. The wire between points A and D is the diagonal brace. The members that go between the floats at points C and D are the crossbars (Figure 2).

The struts are formed in the shape of a trapezoid with the length of the top side equal to the width of the fuselage at the attachment points and the bottom side equal to the spread between the float centerlines. The crossbars that form the bottom of the trapezoid actually extend beyond the edges of the trapezoid to provide attachment points for the floats.

I have found that the easiest way to make float attachments is to use a flat board to represent the top of the floats and then to block up the fuselage in the appropriate position above the board. I then draw two parallel lines on the board making the distance between them equal to the spread between the float centerlines, and then I draw a centerline between them. Next, I draw two lines across and perpendicular to the first lines with the distance between them being equal to the distance between points C and D. The points at which these lines intersect the first two parallel lines are the locations of the four mounting points on the struts. Attach the strut-mounting blocks to these points with the crossbars installed in the mounting blocks. Now, on the float, I carefully measure the distance from the step to the attachment point for the front strut, and I use this measurement to position and draw another perpendicular line on the board—the "step" line. Last, I draw one more line ½ inch in front of the step line and mark it "CG." Now I

These wooden floats have a nice MonoKote finish that matches the airplane's scheme. When not in use, the floats and struts can be stored as a complete unit.

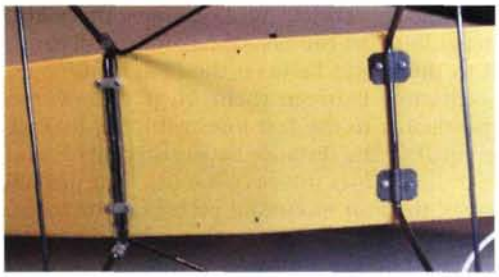
These ¼-scale wooden floats have a ¼x1-inch plywood crossbar for added rigidity. Simple, molded, nosewheel brackets are used to attach the struts to the floats.

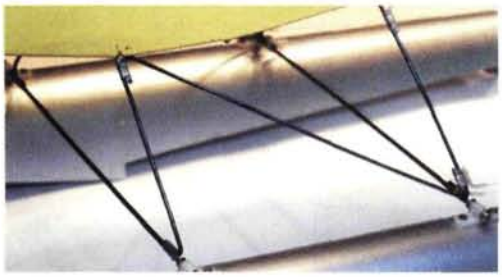
FLYING BOATS

You can also fly off water with aircraft whose fuselages act as the main flotation—flying boats! Flying boats have a step in the bottom of their hulls that's similar to the one found on floatplane floats and pontoons. Smaller outrigger floats are attached to the underside of the wings to help stabilize the model. There are several kits available for these impressive, often multi-engine airplanes.

MANUFACTURER	MODEL	SPAN (IN.)	ENGINE	KIT TYPE	PRICE
Ace	Sea Master	60	.40	Wood/plastic	$249.99
Balsa USA	Laker	70	.40 to .46	Wood	$106.95
Balsa USA	North Star	44	.40 to .46	Wood	$87.95
Gee Bee	Sea Hawk	50	.20 to .40	Wood	$69.99
G and P Sales	Albatross	81	.40	Wood/glass/foam	$324.95
G and P Sales	Canadair CL 215	81	.40	Wood/glass/foam	$324.95
G and P Sales	PBN Nomad (Canso)	104	.60	Wood/glass/foam	$424.95
G and P Sales	PBY 5A Catalina	62/81/104	.20/.40/.60	Wood/glass/foam	$269 to $549
G and P Sales	Republic Seabee	72	.40	Wood/glass/foam	$274.95
G and P Sales	Twinbee	72	Twin .20	Wood/glass/foam	$274.95
Herr Eng.	Aqua-Star	42.5	½A	Wood	$61.95
Hobby Lobby	Osprey	43	Speed 400	Wood/glass	$139
Kyosho	PBY Catalina ARF	68.5	Twin .15	Wood/glass	$245
Kyosho	PBY (revised)	68.5	Twin .15	Wood/glass	$395
Lanier RC	Sea Bird ARF	60	.40 to .60	Wood/plastic	$199
RnZ Models	Beast	48	.60	Wood/foam	$70
RnZ Models	Super Beast	72	1.50	Wood/foam	$140

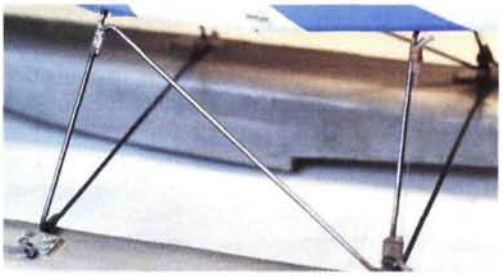
Right: scratch-built Canadair CL-215; Left: Hobby Lobby Osprey; above: scratch-built Short Empire S-23.

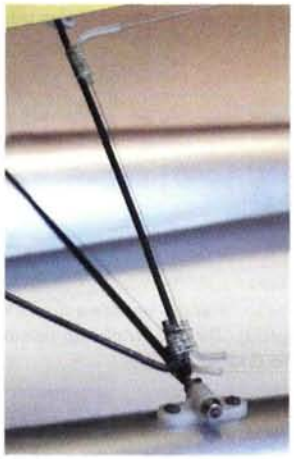




Left and right: these close-ups show the simple bound-and-soldered strut-wire construction complete with crossbars and diagonal bracing. Note the molded attachment brackets.

Left: the strut attachment to the fuselage is straightforward. Here, the front strut wires have been installed in the model's dry-ground, landing gear slot, and a pair of metal tabs connect the rear struts securely to the fuselage bottom. A plywood doubler inside the fuselage strengthens the rear strut attachment.





Left and above: the cable pull/pull set for the water-rudder steering. Threaded couplers and ball links at the air rudder make it easy to tighten and adjust the cables. The formed-plastic tubes at the struts replace the complicated pulley setup.

block up the fuselage over the centerline at the height needed to keep the propeller 2 inches above the board. The plane's CG should be directly above the "CG" line, and the plane's datum line should be at 1½ degrees positive angle relative to the top surface of the board. I generally make saddles out of 2-inch-thick Styrofoam to support the fuselage in the proper position. These are free-standing and can easily be cut to shape.

Once all this has been done, determine the height of the forward strut by measuring the perpendicular distance from point A on the fuselage to the forward crossbar. (This is not the distance between A and C.)

I then draw the front strut to use as a pattern to make the front music-wire strut. The strut should be bound to the crossbar with copper wire and silver-soldered. Next, attach the strut to the fuselage and the building board and reblock the fuselage over the board. If the strut didn't come out exactly according to the pattern, just reposition the fuselage to get things lined up properly, and remeasure to obtain the correct height of the rear strut. After making the rear strut, attach it to the fuselage and board, and make sure everything is positioned properly. If necessary, use shims to make minor adjustments.

Finally, measure the length of the diagonal braces, bend them and silver-solder them between the top of the forward strut and the bottom of the rear strut. By now, it should be obvious that this process would be much easier if the positions of the strut-mounting points on the float were adjustable.

The thickness of the wire used for the struts depends on the size of the airplane. The smallest plane I have on floats is that .40-size Sig Cub; that one has ⅛-inch wire for all of the support structure. The largest is a ¼-scale Cub (I told you I like Cubs), and that

FLOAT KITS

MFR.	MODEL	LENGTH (IN.)	AIRCRAFT SIZE	MATERIAL	PRICE
Balsa USA	¼-scale EDO	44.25	¼-scale Cub	Wood	$124.95
Balsa USA	⅛-scale EDO	59	⅛-scale Cub	Wood	$159.95
Balsa USA	Wave Riders	30	.40	ABS	$40.95
Balsa USA	Wave Riders	36	.60	ABS	$46.95
Balsa USA	Wave Riders	46	1.20	ABS	$59.95
Carl Goldberg Models	Super Float kit	36	.40	Wood	$55.99
Clancy Aviation	Lazy Bee floats	15.25	40-inch Bee	Wood	$29
Clancy Aviation	Lazy Bee floats	23.5	50-inch Bee	Wood	$45
Flitecraft	.25-size floats	29.5	.25 to .35	ABS	$31.95
Flitecraft	.40-size floats	34	.40 to .60	ABS	$37.95
Flitecraft	.90-size floats	38.5	.90 and above	ABS	$39.95
Gee Bee	28-inch floats	28	.20 to .40	Plastic	$35
Gee Bee	33-inch floats	33	.40 to .60	Plastic	$40
Great Planes	.20-size float kit	27.75	.20	Wood	$35
Great Planes	.40-size float kit	34.5	.40	Wood	$45
Great Planes	.60-size float kit	41	.60	Wood	$55
Heli-max	.30 helicopter floats	23	.30 to .40 heli	Vinyl	$18
Heli-max	.50 helicopter floats	26	.50 to .60 heli	Vinyl	$22
Model Magic	28-inch float kit	28	Up to 6 lb.	Foam	$29.99
Model Magic	28-inch kit w/sheeting	28	Up to 6 lb.	Foam	$39.99
Model Magic	32-inch float kit	32	Up to 10 lb.	Foam	$34.99
Model Magic	32-inch kit w/sheeting	32	Up to 10 lb.	Foam	$44.99
Model Magic	36-inch float kit	36	Up to 14 lb.	Foam	$39.99
Model Magic	36-inch kit w/sheeting	36	Up to 14 lb.	Foam	$54.99
Model Magic	40-inch float kit	40	Up to 18 lb.	Foam	$49.99
Model Magic	40-inch kit w/sheeting	40	Up to 18 lb.	Foam	$64.99
Model Magic	48-inch float kit	48	Up to 28 lb.	Foam	$54.99

MFR.	MODEL	LENGTH (IN.
Model Magic	48-inch kit w/sheeting	48
Model Magic	56-inch float kit	56
Radical RC	Full kit (with sheeting)	20.25
Radical RC	Full kit (with sheeting)	27
Radical RC	Full kit (with sheeting)	34.5
Radical RC	Short kit (cores/backbone)	20.25
Radical RC	Short kit (cores/backbone)	27
Radical RC	Short kit (cores/backbone)	34.5
Sea Commander	¼-scale CAP 3000	59.25
Sea Commander	¼-scale S6B	69
Sea Commander	⅙-scale Beaver	45.5
Sea Commander	Gullwing	36
Sea Commander	Gullwing	38
Sea Commander	Gullwing	40
Sea Commander	Mono/tip float	43.25/10.5
Sea Commander	Race Commander	33.5
Sea Commander	Race Commander	43
Sea Commander	Sport Commander	35.25
Sig	¼-scale floats	46
Sullivan	28-inch floats	28
Sullivan	32-inch floats	32
Sullivan	36-inch floats	36
Sullivan	40-inch floats	40
Sullivan	44-inch floats	44
Sullivan	48-inch floats	48
Sure Flite	Molded foam floats	28
U.S. Aircore	Deluxe Explorer floats	36

one has 3/16-inch crossbars and 5/32-inch struts and diagonal bracing. It also has 1/4x1-inch plywood crossbars under the wire ones for additional rigidity.

STEERING

Very few planes can maneuver on water with just the standard air rudder, so unless you plan to fly only on perfectly calm days, you will have to install a water rudder on one or both floats. Again, the size depends on the size of the plane. I like to use oval rudders with the long axis running horizontally. The two Cubs mentioned each have rudders on both floats. These measure 1 1/4x2 1/2 inches and 2 1/4x5 inches, respectively.

There are several ways to operate water rudders and, as with almost everything else, it depends on the plane. If the plane's air rudder extends to the bottom of its fuselage, the simplest linkage is to attach a separate control horn to the bottom of the rudder and run a flexible pushrod under the fuselage, down one strut and back to the water rudder.

A less scale but very simple sport setup: use a metal cable in a long plastic tube that runs from a horn at the air rudder to the tiller arm on the water rudder.

If the rudder does not extend to the bottom of the fuselage, as on a Cessna, for example, you can run the pushrod from the rudder servo and out through the bottom of the fuselage and back to the water rudder. Or simply insert a rod with a steering arm into the nosewheel bracket and run a pushrod to the water rudder. My favorite setup is to use thin flexible steel cable (U-control cable works well) and set up a "pull/pull" system to two water rudders. To do this, I use a double control horn at the bottom of the plane's air rudder and run three cables as follows:

- first, from the right side of the air rudder horn to the left side of the right float's rudder tiller arm;
- second, from the left side of the air rudder horn to the right side of the left float's rudder tiller arm:
- third, from the right float to the left one.

The first two cables run under the fuselage, down the strut and along the top of the floats. The third cable runs along the top of the floats and up and over the rear strut. I run the cables through small-diameter plastic tubes that I heat and bend 90 degrees. I attach these to the rear strut with thread and CA.

WATERPROOFING

Do a few things to the plane to make things waterproof. Wrap the battery and RX in a plastic bag and then in foam rubber. Mount the switch internally and operate it via a thin push/pull wire that exits the side or top of the fuselage. It is a good idea to avoid having exposed servos.

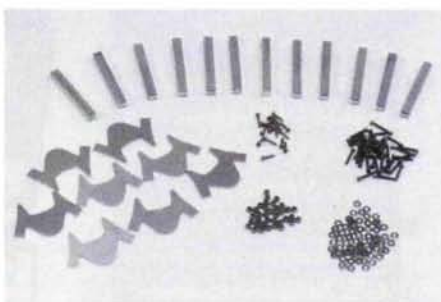
Use "hooded" pushrod exits wherever water is likely to enter (like everywhere!), and pay special attention to getting a good seal at the wing saddle. If you can, coat the framework with Balsarite before you cover it, and waterproof the radio and tank areas with thinned epoxy.

There are a few more things to consider before we actually fly:

- The engine must have a very reliable idle because water taxiing is best done at slow speed, and it is much better to be able to taxi back than to have to retrieve the plane from the middle of the lake.
- You must have a retrieval method, or you'll have to swim for your plane (or wait a long time for it to drift back to shore).
- If you do have a spill (and you certainly will,) you should service the plane immediately. Lift it out of the water gently so the water doesn't slosh all over. Let the water drain out, then wring out the foam packing. Remove the glow plug to get the water out of the engine, then flush the engine with fresh fuel and run it for a few minutes. If the receiver or servos get wet, open them up and blow them dry. If you fly off salt water, just throw everything away!—only half kidding! If you act quickly, flushing everything with fresh water and then blow drying will usually salvage the electronic parts. Flying off salt water is not recommended!
- One last thought: water spray can eat up a wooden prop in no

Above: three water-rudder installations: rudders may be made of metal, plastic sheet, or plywood sealed with resin. Note the rudder attached to the steering rod with a bolt and a metal tab; it is known as a "kick-up" rudder. If this rudder hits something, it will swing up and pivot around its attachment bolt.

AIRCRAFT SIZE	MATERIAL	PRICE
Up to 28 lb.	Foam	$74.99
Up to 45 lb.	Foam	$64.99
3 lb.	Foam/wood	$29.95
5 lb.	Foam/wood	$31.95
7 lb.	Foam/wood	$33.95
3 lb.	Foam/wood	$19.95
5 lb.	Foam/wood	$19.95
7 lb.	Foam/wood	$19.95
1/4 scale CAP	Fiberglass	$495
1/4 S6B	Fiberglass	$350
1/6 Beaver	Fiberglass	$170
.40 to .60	Fiberglass	$113
.40 to .60	Fiberglass	$125
.60 to .80	Fiberglass	$137
.60 to .90	Fiberglass	$198
.40 to .60	Fiberglass	$105
.60 to .90	Fiberglass	$155
.50 to .60	Fiberglass	$104
12 to 25 lb.	Wood	$69.95
.15 to .20	Foam	$23.95
.30 to .40	Foam	$25.95
.50 to .60	Foam	$29.95
.60 to .80	Foam	$31.95
.90 to 1.20	Foam	$35.95
1.20 and higher	Foam	$37.95
5 lb.	Foam	$21.95
4 to 7 lb.	Corr. plastic	$35



This 46-inch float kit from Sea Commander Floats is a great way to put your 1/4-scale model on sea legs. Strong, light and very scale looking, the Sea Commander floats come with all the hardware needed to attach them to your model.

time at all. Use reinforced-fiberglass props on the water.

FLYING WITH FLOATS

A floatplane takes off differently from a land plane in that its tail doesn't lift before the rest of it as speed increases. Instead, the floats gradually rise until they are "on step," at which point the plane really accelerates. The main thing to watch for during takeoff is that the plane doesn't bounce into the air before it's ready to fly. Make sure the plane has reached flying speed before you apply any up-elevator. The initial liftoff with water streaming off the edges of the floats is a sight to behold!

Because of the added drag and weight of the floats, the plane won't fly as fast as it did without floats, and its vertical performance will be somewhat diminished, but other than that, it should fly pretty much as it did before you added the floats.

The main difference I notice when flying a floatplane is the "pendulum effect" they experience at the last half of a roll. They really whip around! Also, landings have to be made a little faster to compensate for the higher wing loading. A perfect landing is made when the float's step and transom "kiss" the surface of the water at the same time. It just doesn't get any better than that!

FLOAT-FLY CALENDAR

DePue, IL, Float Fly, Aug. 13, Lake Depue, IL. Contact Bob Jeppson, (815) 339-2378.

Olympia, WA, Annual Float Fly-In, Aug. 20, Black Lake, WA. Contact Bruce Gale, (253) 845-0705.

Springfield, MO, Float/Fun Fly, Aug. 19-20, Springfield Lake, MO. Contact Harold Wessel, (417) 859-3126.

Woodland/Davis Float Fly, Aug. 19-20, Woodland, CA. Contact Milton Degroodt, (925) 682-2185.

Oak Forest, IL, Annual Float Fly, Sept. 2-3, Twin Lakes, IL. Contact Bernard Zoppa, (708) 957-3854.

Don McKinney Float Fly, Sept. 9-10, Big Spring, TX. Contact James Sawyer, (915) 263-5917.

Midwest Regional Float Fly, Sept. 9-10, Brighton, MI. Contact Darrell Watts, (248) 391-4677; Carl Long, (810) 254-0048; cclong@tir.com; www.geocities.com/~skymasters.

Smithville Dambusters Float Fly, Sept. 29-Oct. 1, Smithville, MO. Contact Wes Parmenter, (816) 532-4350; www.sheepdip.org/sdb.htm.

Greenfield, NH, Fall Float Fly-In, Sept. 15-17, Greenfield State Park, NH. Contact Bob Spear, (603) 654-9814.

Corning Tri Rivers RC Modelers Float Fly, Sept. 16, Lawrenceville, PA. Contact James Anderson, (607) 527-8243; rcanders@stny.lrun.com.

TX/ND RC Seaplane Fly-In, Sept. 23, Hidden Cove Park, Colony, TX. Contact Charlie Viosca, (972) 625-2922 or (972) 294-1443.

Standly Lake Float Fly, Oct. 1, Westminster, CO. Contact Chuck Hobart, (303) 452-3697.

Agate Lake Fall Float Fly, Oct. 7-8, Medford, OR. Site contact: Floyd Grove, (541) 955-0634.

Top of New Jersey RC Club Float & Seaplane Fun Fly, Oct. 7-8, Mountain Lake, NJ. Contact Herbert Kircher, (908) 276-5056.

Perris, CA, Float Fly, Oct. 7-8, Perris Lake, CA. Contact Bill, (909) 653-1717.

Fernandez Float Fly, Oct. 22, Prado Dam, Chino, CA. Contact Eusebio Fernandez, (909) 591-5403.

River City Fall Float Fly, Oct. 21-22, San Antonio, TX. Contact Keith Moody, (210) 657-5259.

London Bridge Seaplane Classic, Jan. 11-13, Lake Havasu City, AZ. Contact Gene Estes, (520) 453-4706.

FINAL THOUGHTS

I'm told that most planes will benefit from additional air rudder/fin area when equipped with floats. Up to a maximum of a 25-percent increase is usually recommended. The additional area is needed primarily for stability, and it's easily added in the form of a fixed fin under the fuselage. I suppose it helps during takeoff, but I have flown most of my floatplanes without additional air-rudder area and have not encountered any real problems.

Float flying is a blast. Try it; you'll like it!

The addresses of the companies mentioned in this guide are listed alphabetically in "Featured Manufacturers" on page 142. ✈

Instant banzai

MRC/ALTECH

EZ ZERO

by Chris Chianelli

In the early '80s, the ARF (almost-ready-to-fly) model-airplane market was totally revolutionized when the name "EZ" entered the scene. Before the EZ's arrival, there were a few crude-by-today's-standards, all-wooden ARFs available, but most ARFs were either all uncovered, injection-molded foam, or they had vinyl-covered foam wings and vacuum-formed ABS plastic fuselages with inner plywood bracing.

When OK Models introduced the name "EZ," the line featured inner wooden framing complete with wing ribs and spars and fuselage formers covered with an all-new triple-layer laminated skin with a high degree of graphic detail and a fuelproof, clear Mylar outer surface. OK Models was quite creative with the new medium; it produced an extensive product line that included trainers, warbirds and even a giant-scale Laser, Diablo, Chipmunk and Christen Eagle. No one had seen anything like these well-detailed EZ ARF models before, and when word got around that they flew as good as they looked, EZ models started showing up at flying fields across the country. The EZ line gained modeler acceptance and enjoyed market success for almost a decade; then, for a number of reasons, the line disappeared from the American market several years ago. Absence not withstanding, loyal consumers never stopped asking about—and wanting—them.

While very high-quality, all-wooden ARF choices abound in today's market, EZ models—with their factory-finished bright graphics and scale detail—still occupy a niche of their own. Their unique design and construction techniques continue to appeal to many modelers, so I'm happy to tell you that the EZ line is once again available. It is being distributed by MRC*/Altech* in Edison, NJ, and its return to American shores is welcomed by many—including me.

SPECIFICATIONS

Model: EZ Zero

Manufacturer: OK Models

Distributor: MRC/Altech

Type: ARF scale warbird

Wingspan: 55.6 in.

Wing area: 539.2 sq. in.

Weight: 6.26 lb. (100.16 oz.)

Wing loading: 26.78 oz./sq. ft.

Engine req'd: .40 to .46 2-stroke, or .53 to .70 4-stroke

Engine used: Enya .80 4-stroke

Prop used: 13x6 and 13x7 Zinger

Radio req'd: 5-channel w/4 standard servos and 1 low-profile retract servo

Radio used: JR 421

Fuel used: Wildcat 15%

Street price: $299 (not including retracts and wheels)

Features: balsa and plywood inner airframe with ⅛-inch triple-lamination outer skin. All accessories and hardware included except for retracts and wheels. Finely detailed finish replete with rivets and weathering.

Comments: if you want instant scale gratification with sport-plane performance, buy this model. It flies as good as it looks. Retracts are required and performed flawlessly.

Hits

- Excellent flight performance.
- Striking scale appearance both in the air and on the ground.
- Good scale detail.
- Smooth retract operation.

Misses

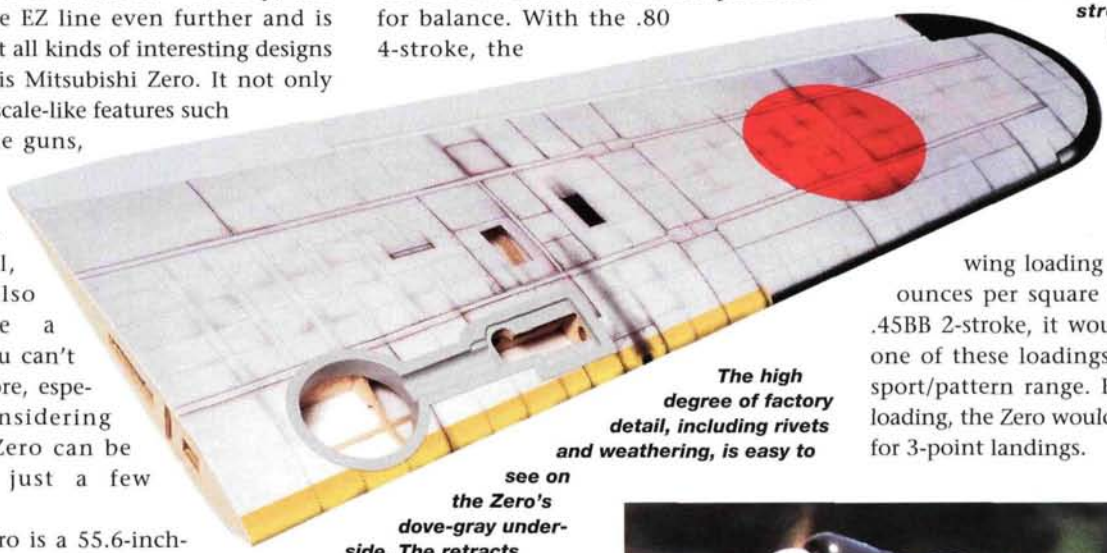
- Wheel collars not usable.

Contents of the box: everything you need except a radio, an engine, retracts and wheels.

For those of you who loved the EZ ARFs of years ago and who are hoping those old designs might be available again, I'm sorry to tell you that OK Models' factory burned to the ground, and the tooling for those old models was destroyed. OK Models, however, has moved into a brand-new factory, has refined the EZ line even further and is turning out all kinds of interesting designs such as this Mitsubishi Zero. It not only has many scale-like features such as machine guns, retracts, rivets and weathering detail, but it also flies like a dream. You can't ask for more, especially considering that the Zero can be built in just a few evenings.

The Zero is a 55.6-inch-wingspan model with 539.2 square inches of area. It weighs in at 100.1 ounces with the Enya .80 4-stroke that I used. After many flights, I can tell you the model doesn't need all the thrust delivered by the .80 and a 13x7 prop. Any strong, well-broken-in .50-size 4-stroke would be a good match for this design. For you 2-stroke guys: if I had used the Enya .45 Super Sport BB, the model would have weighed in at 91.1 ounces. My Zero balanced ever so slightly nose-heavy with the .80 4-stroke with the battery placed in the radio compartment. If you do opt for a lighter 2-stroke, you have the option of placing the battery more forward in the tank compartment for balance. With the .80 4-stroke, the wing loading comes out to 26.78 ounces per square foot, and with the .45BB 2-stroke, it would be 24.36. Either one of these loadings is well within the sport/pattern range. Even at the heavier loading, the Zero would slow up beautifully for 3-point landings.

Retracts (also made by OK Models) are required for the Zero and must be purchased separately. There is no fixed-gear option. The gear's suggested list price is $45. The old aluminum OK Models retracts worked well, but these new ones operate even more smoothly and are probably stronger since they're made of composite epoxy glass castings. The retracts performed flawlessly. Wheels are also not included in the kit.



The high degree of factory detail, including rivets and weathering, is easy to see on the Zero's dove-gray underside. The retracts dropped right in.

FLIGHT PERFORMANCE

This model looks so good in the air. I know, I know; this is the flight performance section, but when a model turns you on so much just by the way it looks doing a high-speed low pass, it makes the flight part of the whole deal so much more exciting and enjoyable. At least, *I* think so. Several of the guys watching at the field commented on how the lines of the EZ Zero "... look so full-scale in flight."

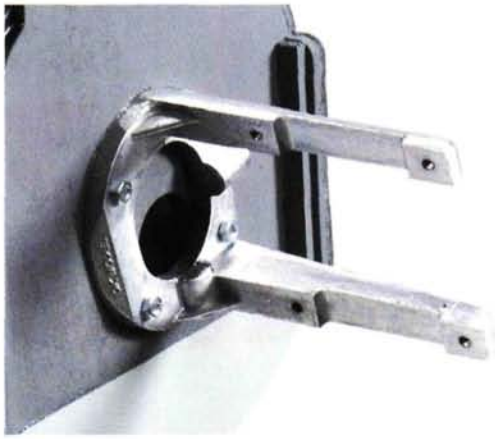
DOWN TO BUSINESS

OK; scale excitement aside, how does it really fly? Like a smooth sport/pattern model. Truly, except for the rudder command, it flies exactly like a low-wing sport plane—the kind you'd feel confident flying every time out. Don't get me wrong; the rudder is very effective considering its smaller scale proportion; it's just that most sport/pattern designs have large rudders that extend well below the datum line. Other that that, the Zero's flight characteristics parallel a sport/pattern design closely—very closely. Rolls are very axial, stall maneuver recovery is very quick, and the Zero just stays on a heading and tracks through the sky. It's very relaxing to fly.

• TAKEOFF AND LANDING

Since it's a scale model, the slow-flight handling of the Zero was the biggest and best surprise. On final, the Zero again has a sport-plane demeanor. Even with the big Enya .80 in the nose and a slightly nose-heavy balance point, the model would slow up beautifully for 3-point landings. You don't have to grease this one in. With a lighter motor, lower wing loading and dead-on balance point, I'm certain the Zero would make perfect WW II carrier-style landings—even with the green Army jungle finish!

For takeoffs on grass, you will need to hold a good amount of up-elevator at low rollout speeds, but as soon as speed builds up, the elevator can be neutralized before liftoff. To keep things straight on takeoff, only the slightest amount of right rudder needed to be applied. This model looks great and is fun to fly. What more can I say?

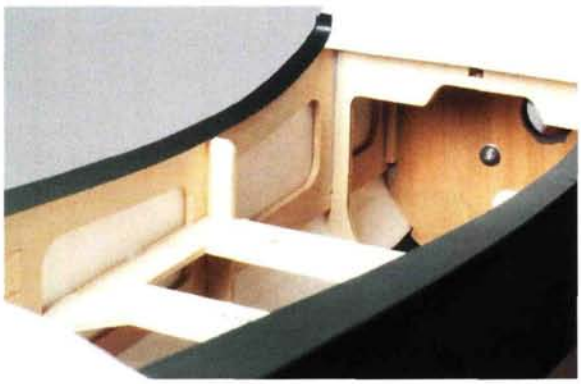


Right: the aluminum motor mount comes mounted on the firewall and has universal mounting bars for .40 2-stroke to .70 4-stroke engines. While the Enya .80 did fit within the cowl, a bit of grinding was required on the rear ring of the mount so that the .80 could move rearward far enough for proper cowl/prop clearance.

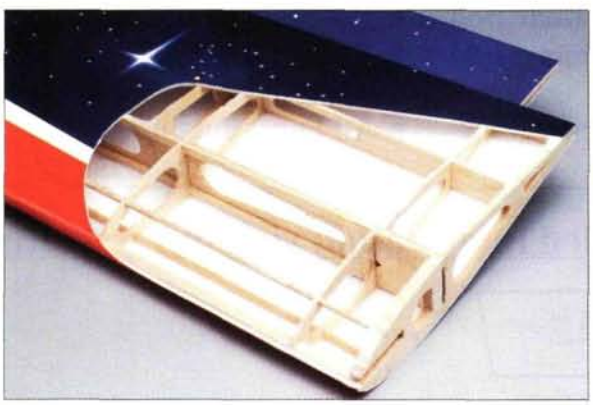
CONSTRUCTION

The 23-page, step-by-step instruction booklet has 95 high-resolution photos to visually support the construction process and, for the most part, is very accurate and clear. You need to be on the lookout for a few specific points during construction. On page 7, the lengths given for the prebent retract control linkages are wrong; they're too short. Measure for yourself—then cut. By the way, there is no fixed-gear option on this kit, so you will need to purchase and install the retract. Make sure that you get a low-profile retract servo, as a standard size will not fit in the space provided near the leading edge of the wing. On page 15, the instructions give you the impression that the stab's lower root cover is to be installed at this point. It is not! This is only for a trial fit and should not be installed until page 18. When you put the upper and lower stab root covers on, line them up together and then glue them. Do not glue one, then the other because you might not get it right. Line them up together—then glue. The only other negatives I have about the kit are with two pieces of hardware. I thought that the nylon clevises were a bit dubious, and as for the press-on wheel collars—just toss them in the garbage. On a grass field, at least, they don't do the job; I found out on the second landing. There was no damage, but I was minus a wheel. Some slight grinding was needed to fit the Enya .80, but this is about the largest engine you would want to stuff into the cowl. Again, if you love 4-strokes as I do, a strong and well-broken-in Enya .53 or Saito .56 would work nicely, as would an O.S. .70 Surpass.

The Enya .80 is a real powerhouse and swung a 13x7 prop at slightly over 8,000rpm. Enya engines do need three or four tanks' worth of initial break-in for optimum power and reliability. Afterwards, however, you will have a powerful engine that will last for many, many flying seasons. I also recommend using the included remote glow-plug wiring because of the plug's close proximity to the prop.



As you can see, the inner fuselage structure is all wooden and somewhat conventional. EZ's 1/8-inch laminated skin forms the round Zero shape nicely. Plenty of room for radio gear here.



I cut the skin off the wing of a CAP 3D—another EZ model you'll be hearing about soon—to show the wing's inner balsa-and-plywood structure. About an 1/8-inch thick, EZ's unique laminated cover forms a resilient outer skin that adds to overall strength.

With the ARF thing going as strong as it is, giving the consumer many choices, it's great to see EZ back here in the States. They do offer something a little different. They also offer bright graphics and detailed appearance, light weight and a reputation for excellent flight performance. The Zero flies like a sport/pattern design. As I understand it, there will be about a dozen new offerings of other EZs this year alone. I already know of a Texan with retracts, a .45-size Extra 330L, a Sukhoi and a super-sleek, red, white, blue and chrome modern pattern ship called the Stingray. Who knows what else OK Models has up its sleeve? I can't wait!

**Addresses are listed alphabetically in "Featured Manufacturers" on page 142.* ✈

MODEL AIRPLANE NEWS
PRODUCT
REVIEW

GREAT PLANES

Giles G-202

by Keith Palmer

SPECIFICATIONS

Model: Giles G-202

Manufacturer: Great Planes

Type: aerobatic sport scale

Wingspan: 59.3 in.

Wing area: 617 sq. in.

Weight: 6 to 7 lb.

Engine: .46 to .61 2-stroke or .91 4-stroke

Engine used: O.S. .61 FX

Radio req'd: 4-channel w/5 or 6 servos

Radio: Futaba 5UAP with 5 servos and Y-harness for ailerons and extension for the rudder servo

List price: $129.99

Features: crisp die-cutting and lite-ply fuse construction; prebent landing gear; ABS wheel pants and cowl; clear canopy.

Comments: the Giles G-202 is a pleasure to build and a real crowd-pleaser at the field.

Hits

- Crisp die-cutting on all parts.
- Very accurate parts fit.
- Removable fuel-tank platform.
- Very easy to follow plans and instructions.
- Complete hardware package.

Miss

- Cut line on the bottom of the cowl is approximately ¼ inch off.

PHOTOS BY KEITH PALMER

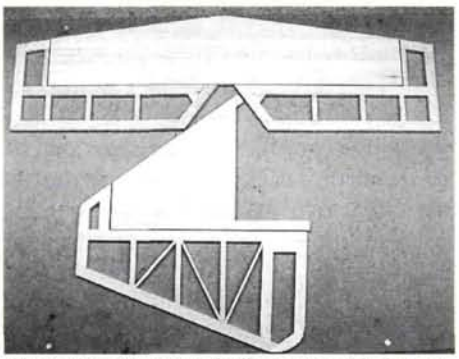
Midsize sport-scale aerobat

The Great Planes* Giles G-202 is an aerobatic sport-scale plane that's legal for both MINIMAC and IMAC competitions. It's modeled after a Giles that's owned by Bob Stark—an avid International Aerobatic Club competitor and judge. Stark's Giles sports a bright yellow and blue color scheme that makes it highly visible in the air and gives it eye appeal on the ground, so I decided to use those colors, too. The Giles' square shape makes it extremely easy to build and even easier to cover, and its wide fuselage and thick wing make radio installation a snap.

The author prepares for the first test flight.

The Giles G-202 kit is CAD engineered and features tab-and-slot construction. It includes laser- and die-cut balsa and ply parts, prebent aluminum landing gear, ABS cowl and wheel pants, a clear plastic canopy, a hardware package that includes a fuel tank with a removable mounting tray that you can slide out for maintenance and an instruction manual.

The parts fit so accurately that it is almost impossible to build a crooked wing or fuselage, even if you use your couch as a building board!



The tail feathers are built up out of balsa—a light, strong assembly.

• **Tail feathers**. The stab and fin are built over the plan out of 3/16x1/4- and 5/16x1/2-inch balsa sticks. The only die-cut pieces are a stab leading-edge (LE) brace and the stab center section. The stab's trailing edge (TE) is reinforced with a 10-inch-long, 3/16-inch-square basswood spar. After the stab and fin have been framed up and sanded flat, they are sheeted with 1/16-inch-thick balsa and then finish-sanded—finished before you know it!

The rudder and elevators are framed up over the plan using 5/16x1/4- and 5/16x1/2-inch balsa sticks. These parts are not sheeted, and I spent only half an hour building them. I used thin Great Planes CA to frame up the tail feathers and medium CA to glue on the stab and fin sheeting.

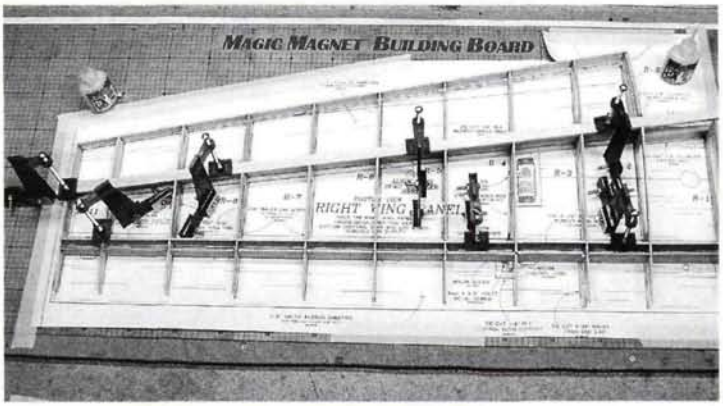
• **Wing**. Building the wing was a thrill because everything fit together so nicely and was soon finished. The LE sheeting is glued together first using three, 3x30-inch pieces of 1/16-inch-thick balsa. These sheets are then cut at an angle to form left- and right-hand sheets. The next step is to glue the 1/8x1/2x13-inch basswood spar doublers to the 32-inch-long spars. These doublers are on the inboard section of the wing panels, where most of the stress will be. The two wing panels are built upside-down over the plan.

Next, pin one of the spars over the plan with the basswood doubler facing upward. I used my Great Planes Magic Magnet Building Board instead of pins because four magnet clamps accomplish as much as about a dozen pins.

Then position the tip rib and the third rib in from the center and into the notches in the main web and the aileron web. There are four web spars for each wing panel: LE, main, aileron and TE. These run the length of the wing panels and are notched to line up with notches in the ribs. This ensures a perfectly straight wing as long as the parts are properly seated in the notches.

Now pin the main spar web to the top spar, aligning the two ribs over the plan. The rest of the ribs can now be placed in their notches, and the LE web and aileron web can be positioned in the rib notches. After making sure that all the webs are down against the board, you can glue the joints with thin CA. The bottom spar and basswood doubler are now glued into place in the rib notches and against the main web.

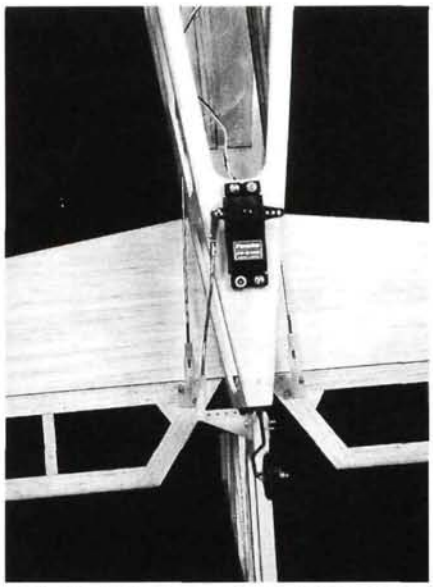
Now glue the aileron servo tray and control-horn support into place and sheet

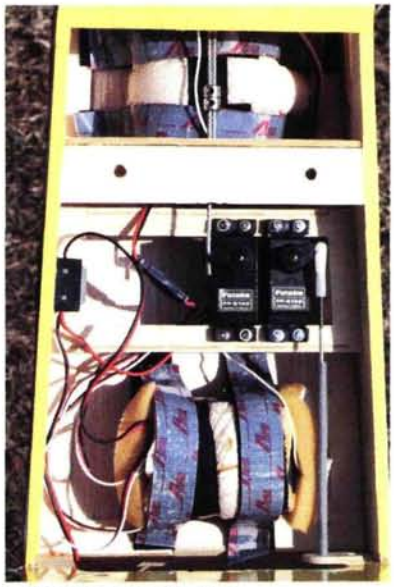


The Great Planes magnetic building board greatly eases wing assembly.

the wing according to the plan. Then join the completed wing panels using a die-cut wing joiner that's made out of three pieces of ⅛-inch ply.

Now you have only to glue on the preshaped LEs and wingtips. After you've finish-sanded the wing, cut out the ailerons and glue on the wing TE and aileron LEs and sand them to shape. No center-section reinforcement is necessary.





Left: the rudder servo is mounted underneath the tail of the fuselage. Right: there's plenty of space in the roomy fuselage for the radio gear.

• **Fuselage**. This is built almost entirely out of ⅛-inch-thick lite-ply. The large lightening holes in all the sides do not weaken the structure. All of the bulkheads come drilled, so it's easy to install the pushrods.

Build the fuselage over the plan by first fitting the four bulkheads to the fuselage top. Right thrust must be built in, so be careful to correctly line up the fuselage top over the plan. Now fit the right and left sides into the bulkhead notches. Then fit the fuselage bottom and mid-fuselage bottom into their notches.

After making sure that everything is properly seated, use thin CA to glue the structures together. All of these parts fit together so well that I could pick up the fuselage before I had glued the parts, and it did not fall apart.

Install the wing-hold-down block, and bolt the wing to the fuselage. Two dowels hold the wing on the front of the fuselage and two ¼-20 nylon bolts hold the wing down at the back. After you've bolted the wing into place, assemble the belly pan, which is made out of ⅛-inch lite-ply, and glue it into place on the bottom of the wing. Two cardboard tubes are glued inside of the belly pan to allow access to the wing bolts. Now glue the firewall, the landing-gear mount and the top front fuselage formers into place and sheet the top front of the fuselage with 3/32-inch balsa. After the fin and stab have been glued into place, glue in the turtle-deck formers and sheet them with 3/32-inch balsa.

• **Radio installation**. The pushrods are made out of 1/16-inch wire that's glued inside Nyrod sleeves and run the length of the fuselage. They're supported by the predrilled bulkheads. These pushrods are stiff and don't bind. The split elevator servos are very easy to hook up. One elevator pushrod is connected to the servo output arm, and the second is connected to the first with two wheel collars that hold them together near the output arm. You have the options of mounting the rudder servo inside the fuselage and using a long pushrod, or mounting it outside the fuselage near the rudder using a short pushrod and a servo-lead extension; I opted for the latter. The G-202 uses dual aileron servos, so you'll need a Y-harness to hook them up.

• **Cowl and wheel pants**. These are formed out of ABS plastic and are very easy to assemble. The wheel pants have overlapping edges that, when glued together with thin CA, make a very strong joint. The cowl has very nice cut lines

FLIGHT PERFORMANCE

• TAKEOFF AND LANDING

After starting the engine, I pointed the Giles into the wind and slowly opened the throttle. The plane took off in a shallow climb as straight as an arrow—perfect! Not one trim correction was needed. Nor was there any need to add right rudder because of the 2 degrees of right thrust built into the firewall.

Landings are a breeze; the Giles will slow down to a hover without snap-rolling, and the controls remain responsive even on low rates—truly amazing!

• LOW-SPEED PERFORMANCE

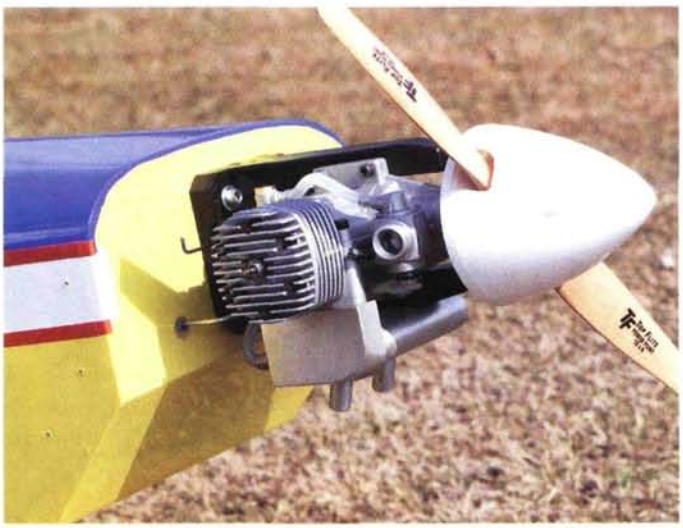
At low speeds, the Giles handles as easily as a trainer. I particularly like to do low, slow aerobatics on a calm day—a real crowd-pleaser.

• HIGH-SPEED PERFORMANCE

At full throttle and with the O.S. .61FX swinging an 11x6 Top Flite Power Point prop, the Giles zips along nicely. When you point it straight up, it will climb out of sight without slowing. There was also no trim change between full throttle and low speed, and that speaks well for the airframe's design, i.e., incidence and built-in right thrust.

• AEROBATICS

When I put the Giles through the wringer, it did not disappoint me. Knife-edge flight was spectacular: put it on knife-edge and add just a little top rudder, and it will fly on knife-edge out of sight. Input full rudder, and it will do one of the nicest knife-edge loops you've ever seen. It snap-rolls very crisply, both inverted and right-side up, and stops the moment the sticks are centered. The Giles also tracks straight, does both inside and outside loops and requires no rudder trim to compensate for torque.



The side-mounted O.S. .61FX engine and Top Flite 11x6 prop provided ample power for the Giles G-202.

molded inside that make cutting it out and fitting it very easy.

A few words of caution: the cut line on the bottom of the cowl is in the wrong place. I cut my cowl out to the lines, and the bottom was about ¼ inch short. The cowl halves are held together with thin CA and an ABS reinforcement strip. With an O.S.* .61 FX engine mounted, I mounted the cowl on the fuselage, securing it with three screws on each side.

Next, drill the mounting holes in the plywood fuselage out to 3/16 inch, and glue in plastic inserts to provide a strip-proof hole—a very good idea.

FINISHING

The instructions tell you how to balance the model laterally before you cover it. This is very important if you want to get the full potential out of this airplane.

I covered the model using Top Flite MonoKote*. As long as you follow the sequence in order, you cannot go wrong.

I painted the cowl, wheel pants and canopy with Top Flite* LustreKote. Note that LustreKote cannot be sprayed right from the can onto butyrate; it will curl the edges of the canopy. Spray the paint into a jar and let it sit for one hour to allow the solvents to evaporate; then apply the paint with an airbrush.

You must glue on the painted canopy within three hours of painting it, or its edges may still curl. If you glue the canopy to the model and then paint it with an airbrush, you won't have any problems.

AT THE FIELD

I ran two, 12-ounce tanks of fuel through the O.S. .61FX, and it was ready to go. The first two flights were low slow passes for the photographer, and I was amazed that a competition airplane could handle like a trainer. After the photo session, I put the Giles through the wringer, and it did not disappoint me.

Great Planes has done a truly magnificent job of designing and manufacturing the Giles G-202. The kit goes together very quickly and builds straighter than any kit that I have assembled in the last 38 years. It will make any Sunday flier look like a MINIMAC competitor.

**Addresses are listed alphabetically in "Featured Manufacturers" on page 142.* ✈

INTER-EX Fly-In

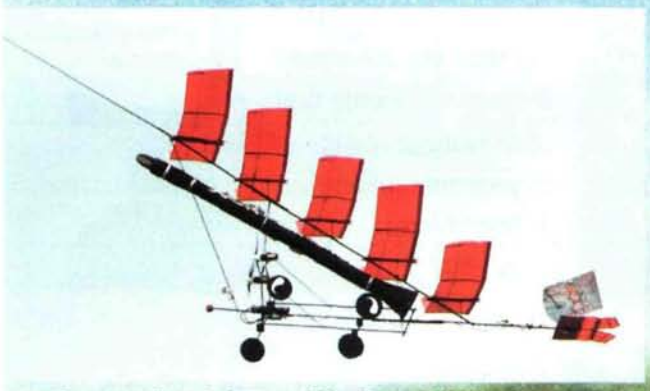
by Guy Revel

Inter-Ex is unique in the modeling calendar. It is not a competition but a simple, low-key electrics meet that leaves ample time for discussion between participants. They do not even need to register before arriving in Nederweert, a small city in southern Holland, not far from the German and Belgian borders.

The modelers who attend Inter-Ex are very special people. Their primary interest is experimenting, whether with novel structures, unusual aerodynamic configurations, or simply with strange shapes that look as though they wouldn't be able to fly. But to earn one of Inter-Ex's many honorary prizes and trophies, there is only one requirement: the creation must fly.

On average, more than 100 entrants come to fly on the magnificent Nederweert Model Club field, and they bring nearly 200 models. This year, bad weather prevented many from attending, but more than 100 models were presented and flown.

Of course, one can always count on some kind of classical creations, i.e., flying wings and canard models of many different types and, more prominent during the past decade, many kinds of scale birds. With these models, builders try to get rid of all vertical surfaces, sometimes manage movable wings and heads, beaks that open, and sound effects (thanks to an electronic circuit and loudspeaker and a recording of a real bird's cry). Many of these models display some kind of innovation and most fly quite well for the pleasure of the many local spectators, who would never miss such a meet.



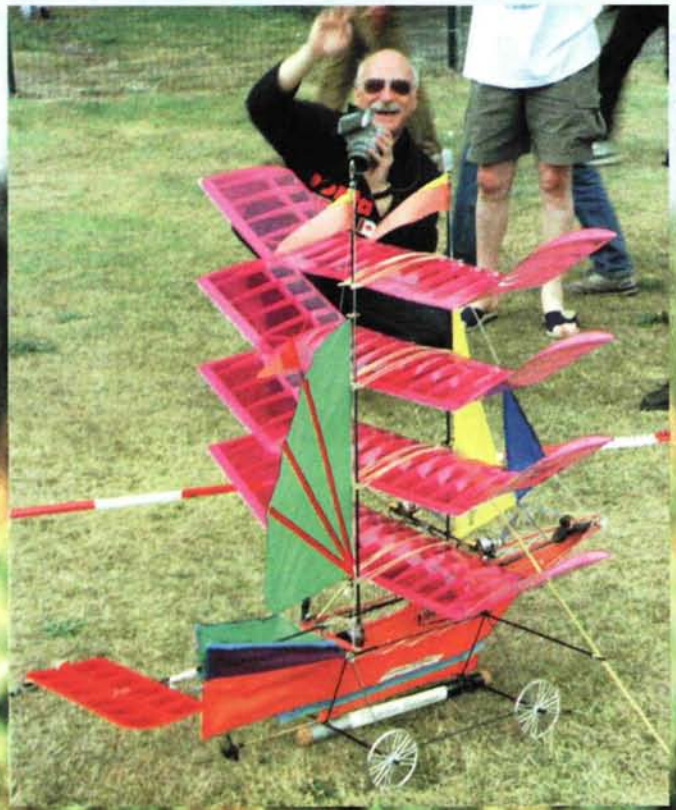
Because the originator of the "Inter-Ex" idea, German modeler Josef "Jupp" Wimmer, plays the clarinet, Peter Haas decided to build a flying clarinet; here is the strange result. Two small motors provide power.

Stars of the show: the ornithopters. At left is an ornithopter built by the late Theo Gordijn and flown by Eric van den Hoogen; on the right, the "Truefly" by Albert Kempf of southern France.

Canards are often the subject of experiments. Both of these are electric-powered. Note the two Mabuchi 380 motors mounted behind the front plate of the lower model.

Europe's electric circus

Left: Eric van den Hoogen again presented his famous giant electric-powered Westland-Hill "Pterodactyl" Mk. IV. He subsequently competed and won with it against gas-powered models in a large-scale competition. Below, top to bottom: British modeler Steve Webb again brought a fleet of very strange contraptions that everyone said would not fly. Here is the "Boobtoob"; we could probably call it a biplane with both wings side by side. Center: the most surprising of Steve Webb's creations: the "Wringlet." This model is made of two carbon rods and a few cross-members, and it's covered with spinnaker sailcloth. Two Mabuchi 380 motors provide the power. The radio equipment and battery are located at the bottom, and this puts the CG about as low as possible! The model is said to be virtually indestructible. Bottom: question: can you bank a round aircraft?



Background shot: it flies! Much to the amazement of many participants and spectators, Albert Kempf's "Truefly" flies at every opportunity and—in spite of limited power—with no perceptible difficulty. Here, the wings are beginning their downstroke. Left: one of Peter Haas's creations this year was his interpretation of a "flying boat"—in this case, the "Flying Dutchman." As the name might imply, Peter made this model especially for his visit to the Netherlands. At takeoff, the landing-gear cart remains on the ground.

As you might guess, many of the entrants attend this meet year after year, as it is their only opportunity to meet other model airplane experimenters. Some well-known attendees are Sieghard Dienlin of Germany, who designed the Mikrosol and Nanosol solar-powered miniature models (see February '00 "Final Approach"), Stefan Dolch of Ludwigshafen, Germany, now world-famous for his Stubenfliege indoor slow-fly model, and Eric van den Hoogen and his teammate Aad van Sorgen, who built and flew the giant, electric-powered Horten and Westland-Hill Pterodactyl scale models.

FLYING CIRCLES AROUND THE REST

One of the stars of the show, so to speak, was British entrant Steve Webb. We could hardly believe his models were flying machines—they appeared to be nothing more than some kind of ring or short tube.

Now we all know that annular wings are not entirely new, and even an experimental prototype for a vertical takeoff jet fighter, the French Coleoptere, was produced in the '60s. But in the case of Steve Webb's models, there were absolutely no control surfaces—not even vertical or horizontal surfaces to provide some kind of a level reference. And those models flew—all three of them!

The annular wings are, of course, just wings of infinite aspect ratio, and they can create lift provided the angle of attack and the center of gravity (CG) are correctly adjusted. In Steve's models, the CG (mostly defined by the RC equipment, battery and motors) is quite low. This provides some kind of pendulum stability and keeps—at least within certain limits—the "low side" down and the "top" up. You will also notice that the motors are placed under the geometric centerline of the model.

Elevator control is provided by the motors: more power makes the model tend to climb. Reduce the power, and the model dives, or at least follows a descending path. As for lateral control, each motor has its own speed control, and a transmitter mixer enables differential motor control. To turn right, more power to the left motor, and vice versa.

To say that the system works as well as a conventional aircraft would be an

Top: an unusual canard that uses twin booms to support the front wing and a centrally mounted O.S. Wankel engine. Center: this type of canard glider with biplane joined wings is a specialty of Wil van Loon's, who improves his models year after year and achieves commendable results. Bottom: another model by Wil van Loon: this time, it's a curious joined-wing glider that could almost be described as a delta.

Below: Peter Haas of Berlin traveled a great distance to participate in the meet. He is a specialist in large, entertaining models that use carbon rod. This one, nicknamed "Edith Piaf" after the popular French singer of the '50s (she is pictured on the fin), was built for a meet in France last year. The array of power units on the "Edith Piaf" is impressive: no fewer than 24 Graupner Speed 400 motors! Just visible on top of the aircraft are the Eiffel Tower and the French flag! Inset below: the winners of the major trophies.

Above: the "tube" coming out of the bird's beak is, in fact, the propeller shaft. An electronic system makes the bird open its beak and cry at random during the flight. Right: this very nice—and large—bird of prey is electric-powered and of all-wooden construction. A transparent Plexiglas central fin provides yaw stability. Once in flight and in a thermal, the effect is extremely realistic. Below right: the Inter-Ex meet in the Netherlands always attracts many spectators. The club's flying field is exceptionally well laid out and well lit, with permanent buildings and amenities such as showers for the campers.

exaggeration, but Steve Webb's models fly, and they are practically indestructible. In addition, they entertained the spectators, who loved seeing the strange flying rings fly.

A TRUE ORNITHOPTER

Unquestionably, the highlight of the Inter-Ex meet was Albert Kempf's model, "Truefly." Flapping-wings experiments have been going on for as long as aviation has existed—and even before—but until now, no amateur modeler has succeeded in flying a true RC ornithopter in which rigid flapping wings provided all of the thrust and lift. A few RC models have flown using a modified sail where cloth takes the place of a true aerodynamic airfoil, and we have regularly seen such models at Inter-Ex, including a very refined model by Theo Gordijn of the Netherlands. Like most modelers since the middle of the last century, Gordijn relied on a soft wing made of a stiff front spar and a cloth surface, modified by various stiffeners but able to deform and change the effective angle of attack during the cyclic movement.

In early 1999, Theo Gordijn decided to encourage creative work on this subject by creating a special Inter-Ex trophy for ornithopters. He did not know that a true and very different ornithopter had been flying in France since early spring, 1998. A few weeks later, Theo Gordijn passed away, leaving his finished model in the hands of his friends Eric van den Hoogen and Aad van Sorgen of Pterodactyl fame.

When Albert Kempf arrived at the Inter-Ex site, he was greeted with incredulity. His ornithopter's rigid, built-up model wings were a bold departure from contemporary thought in ornithopter design. In addition, the model's first flight attempt proved unsuccessful because of an old battery. After Albert installed a new battery, just one flight caused all of the surprised modelers to leave their dinners under the marquee to go watch the world's first fully controllable, true rigid-wing ornithopter fly. The model flew several more times during the weekend; a century-long dream had come true.

I do not doubt that when this technology has been refined and the operational limits more closely appreciated, many more similar ornithopters will be flying. Perhaps we'll even see a man-carrying ornithopter, as Icarus and Leonardo da Vinci dreamed of. But one thing is certain: no one will ever forget the first man who made the dream come true thanks to unconventional thinking, or "querdenken," the phrase used by Inter-Ex originator Josef "Jupp" Wimmer.

Inter-Ex cultivates modelers' creativity and will continue to do so year after year. Thanks to Inter-Ex, its German originator Jupp Wimmer and its Dutch organizer Paul Vissers, there will always be something new in the RC modeling world. ✈

MODEL AIRPLANE NEWS
FIELD & BENCH
REVIEW

YELLOW AIRCRAFT F/A-18 HORNET

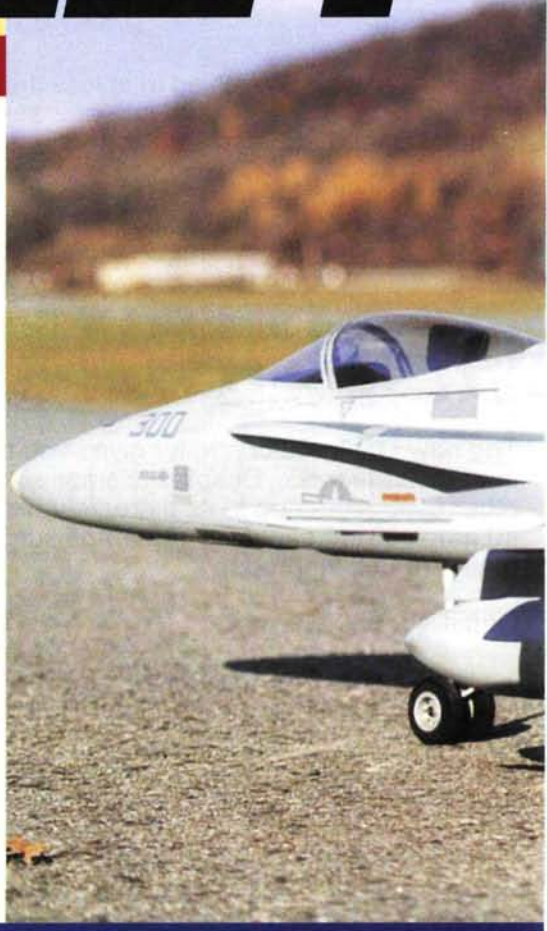
by Bob Boswell

Impressive 1/10-scale Navy fighter

With the Yellow Aircraft* F/A-18 Hornet ducted-fan kit, you can reproduce one of the Navy's most advanced fighters as accurately as possible. Yellow Aircraft's goal is to build high-quality scale aircraft with much of the labor-intensive steps and detailing already completed, so that construction time is minimal and the modeler can be flying in a reasonably short time. The Hornet is testimony to this effort, as the fiberglass fuselage is fully detailed with all panel lines, access hatches, antennae, gun ports, etc., already molded in, as well as presheeted foam airfoils and molded fiberglass stab, vertical fin tips, missile rails, cockpit tub and canopy frame. All wood is precut and sanded to a nearly perfect fit. Semi-scale landing-gear struts, machined wheels and tires and pneumatic brakes are available, as are several choices of ordnance and mounting pylons.

Bob Boswell shows off the Hornet before its first flight.

PHOTOS BY LUCE SIMARD & FRANK FANELLI



FLIGHT PERFORMANCE

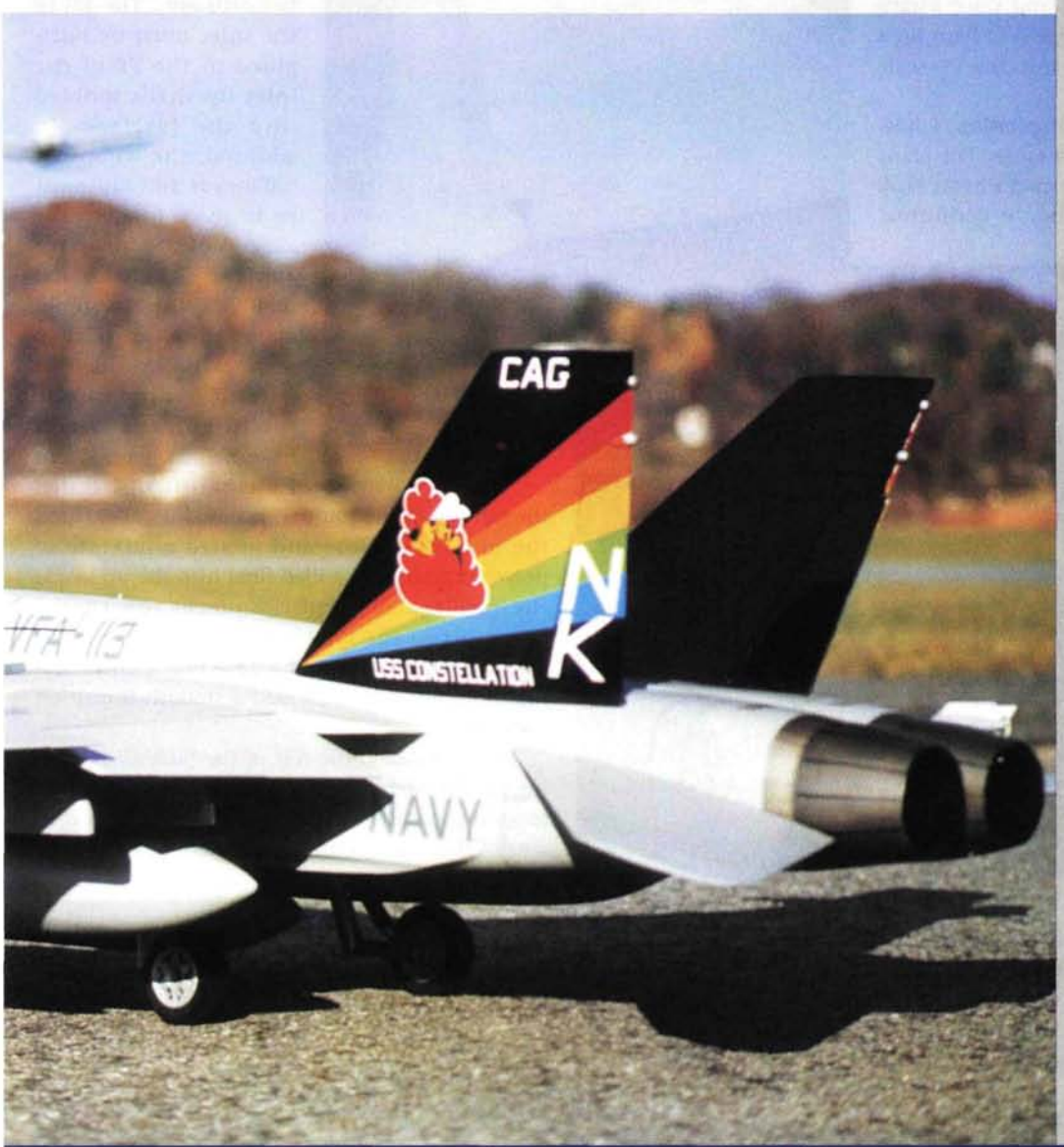
• TAKEOFF AND LANDING

After fueling up, I double-checked all flight-control directions and steering then set the engine mixture. I taxied the F/A-18 to the end of the runway, turned into the wind and advanced the throttle. Acceleration was good, and after about 400 feet, I fed in a little up-elevator; the Hornet rotated and was airborne. Climb-out was surprisingly steep for the model's weight; the leading-edge root extensions add a lot of lift.

Landings are exceptionally slow for a 14-pound, scale jet that is capable of more than 150mph speeds. Just before touchdown, raise the Hornet's nose to bleed off speed, and the model will touch down on the mains first followed by the nose for a perfect scale landing.

• STANDARD FLIGHT AND AEROBATICS

After the model attained a safe altitude, I trimmed the stabilizers. I used only a click or two of elevator but almost all of the aileron trim.



SPECIFICATIONS

Model: single-engine F/A-18 Hornet

Type: 1/10-scale, high-performance sport jet

Manufacturer: Yellow Aircraft

Wingspan: 47 in.

Length: 67.5 in.

Power req'd : .82 engine and up with 5¼-inch tractor-type fan unit

Power used: Dynamax fan unit and O.S. .91 with JMP tuned pipe

Weight: 11 to 13 lb. (14 lb., 3 oz. as built)

Price: $625

Features: one-piece, detailed fiberglass fuselage; molded fiberglass access hatches; fiberglass canopy frame and clear, vacuum-formed canopy; fiberglass vertical fin and stabilator tips, missile launchers, inlet and exhaust ducts; precut formers and bulkheads; sheeted foam-core stabilators and wings (LE already installed); pressure-sensitive decals.

Comments: because the Yellow F/A-18 comes so highly detailed and prefabricated, it's easy to build, and the finished model looks great.

Hits

- Prefabricated, high-quality parts.
- Comes impressively detailed.
- Quick to build.
- Flight controls can be set up according to the builder's preference.
- High-performance flyer.

Misses

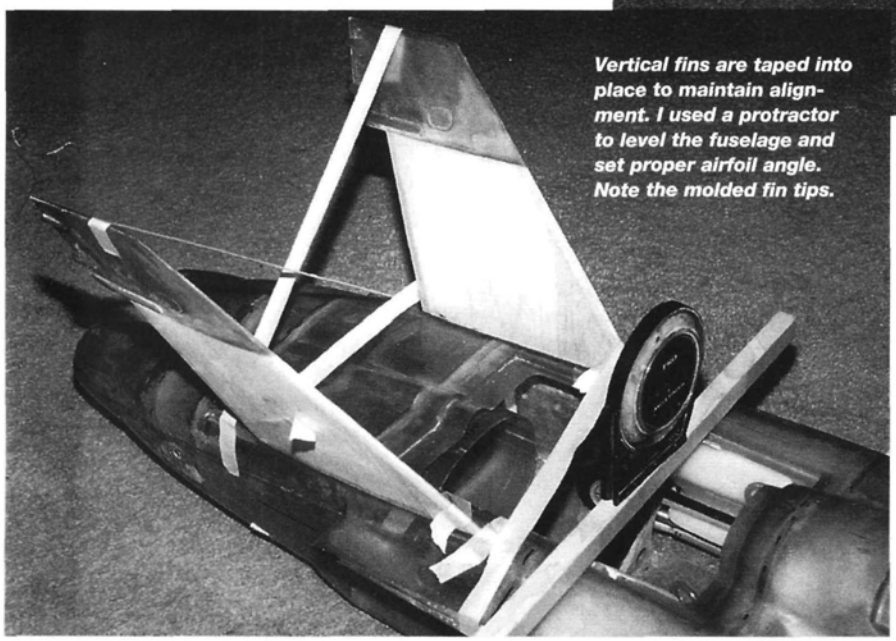
- Very small aft access hatch supports.
- Conformal fuel tanks somewhat difficult to remove for maintenance.
- No access to steering servo; I added a small hatch.

I think that this was due to a slight difference in the airfoil at the LE of the wing that occurred when I installed the LE flaps. I set up for an aileron roll downwind. The roll was very axial but a bit slow for my taste at full stick deflection, with no tendency to over-rotate when the stick was released. Next, I tried an Immelmann, building up airspeed in a shallow dive, then applying a little backpressure on the stick. It was obvious as the Hornet entered the maneuver that there was ample power for a large half circle. As I half-rolled out, the nose dropped slightly; a slightly higher roll rate would have helped here. The next two flights reinforced my original impression: set up as per the manual, elevator was adequate, but another 20 to 30 percent could be added to the roll rate. Although I have not yet landed using the LE and TE flaps, I deployed them in slow flight at altitude. The result is an increase in sink rate, which can be compensated with elevator trim. With about 30-percent power, the nose can be held at a higher angle of attack without increasing airspeed. This should allow a lower stall speed as well as landing speed.

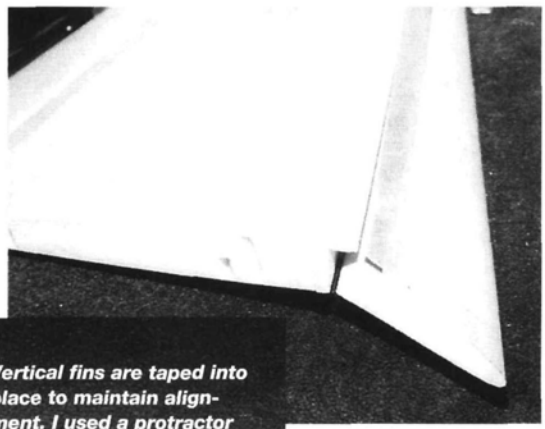
OPTIONS

Before beginning construction, there are several choices to make with regard to flight controls. Although the manual suggests that separate aileron and elevator controls are more responsive, the Hornet can also successfully be flown using full flying stabs for both pitch and roll. Also, flaps and rudder are not necessary, so if you want simplicity, two high-powered servos for "taileron" will provide total flight control. Because the Hornet's wing is relatively thin outboard and wouldn't accommodate most servos, I chose to use tailerons for roll and pitch. I also installed rudders, as they are of great help in crosswind situations, and I opted to install flaps, as they would shorten takeoff distances and aid in grass field operation. The full-size Hornet has full-span leading- and trailing-edge (TE) flaps, and since I have always wanted to attempt leading-edge (LE) flaps on a model, I also elected to design these into the 1/10-scale wing.

Having decided on the flight configuration, I now had to make a choice concerning fuel tanks. The plans show placement of a single, 24-ounce Sullivan tank between the cockpit and the engine, or conformal tanks on either side of the fan. While the conformal tanks make the engine compartment rather cramped, I chose them for two reasons: they are very close to the CG, so pitch trim changes are not necessary as fuel is consumed, and together they hold 31 ounces of fuel—6 ounces more than the single tank.



Vertical fins are taped into place to maintain alignment. I used a protractor to level the fuselage and set proper airfoil angle. Note the molded fin tips.



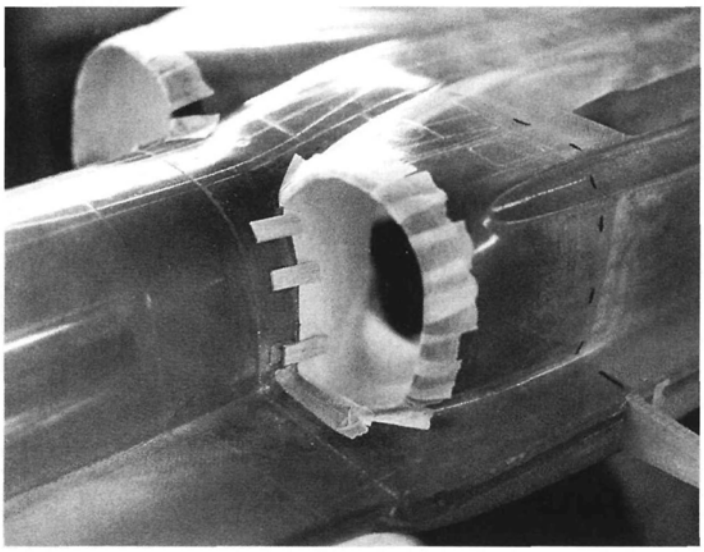
View from port wing root of LE flap in extended position.

CONSTRUCTION

The fuselage is an exquisite example of glass work; the amount of detailing molded into the Hornet is impressive, to say the least. The detail is crisp, flawless and, with the exception of the molding seams, needs only a light sanding to be ready for the finish. There are three access hatches in the fuse: the most forward is the cockpit (under which the nose gear is installed), the second begins several inches behind the cockpit and provides starting access (and installation of the 24-ounce Sullivan tank), and the third is between the wings and provides access to the engine compartment. Each hatch is molded separately and is secured by only two small locating pins and a spring-loaded latch. The lips on the aft hatch are quite small and require small pins to position correctly. I used 0.062-inch music wire; the 3/32-inch wire suggested in the manual required that I remove too much material in the already tiny surface. I think Yellow Aircraft should have made these lips a little larger to support the pins. I used the conformal tanks and thought that the open area under the middle hatch was an ideal location for a plywood tray to hold the retract valve and its servo, on/off switch and charge jack, pneumatic fill valve and throttle servo. This shelf provides easy access to these components and room underneath to mount the air tank.

After removing the excess material from the fuselage, I installed the inlets. I painted the inlets before I installed them because it's easier and causes less mess inside the airframe. The LE of the inlet must be butt-glued to the TE of the inlet lip that's molded into the fuselage. In addition, the wing-spar bulkheads and fan must be in place to align the aft end of the inlets. To achieve a close fit, remove a little material at a time and keep rechecking. Molded-in recessed lips to facilitate the alignment would have helped here. When I was satisfied, I sealed the outside of the joint with masking tape, stood the fuse on its nose and poured a mixture of polyester resin and milled fiber into the lip inside the fuselage to bond the pieces together. I strengthened the joint with glass tape in those areas I could reach. With a little filling and sanding, the inlet joint provided a smooth transition for airflow.

I then installed the rest of the bulkheads, paying careful attention to the two aft bulkheads that support the stabilator pivot mechanism. This consists of two ball bearings supported by a plywood

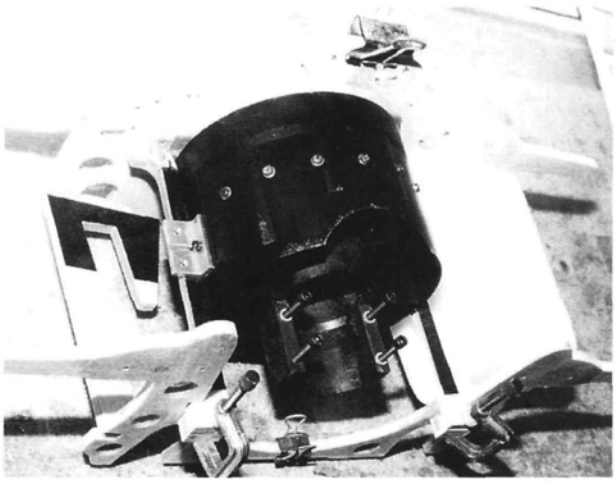


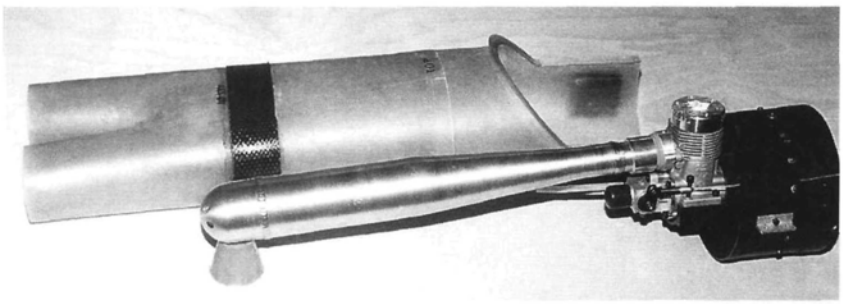
I sealed the inlet/fuse joint with tape before I filled the cavity between them with a mixture of epoxy and milled fiber.

box. The box is epoxied between the two bulkheads to create a rigid aft fuse section. The pivot shaft is made out of titanium and is epoxied into place in the stab; rotation within the stab is prevented by a small pin that passes through the shaft perpendicular to its rotational axis. The instructions suggest using 5-minute epoxy when you assemble the bearing boxes, and I strongly recommend using a good, slow-setting epoxy. I even reinforced the joints with small pieces of carbon fiber. Because of the size of the stabs and potential high speeds the airframe will encounter, a tremendous load will be placed on this area.

Next I fitted the retracts, and I had to remove some of the fuselage skin to allow the tires to clear when they retracted. I used Rhom-Air* retracts, and to allow the scale struts to clear the retract housing, I had to disassemble the retract unit to reverse the end to which the air cylinder is mounted. The cylinder is now on the forward side of the retract, and the strut retracts to the rear.

The plans show the steering servo placed forward of the retract, under the front windscreen. After you've installed it, there is little or no access if the servo fails or the cables break. Although I probably could have found another location, I decided to cut a small hatch on the underside on the nose, directly over the servo. This hatch is held in place by four tiny screws and allows complete serviceability and adjustment.

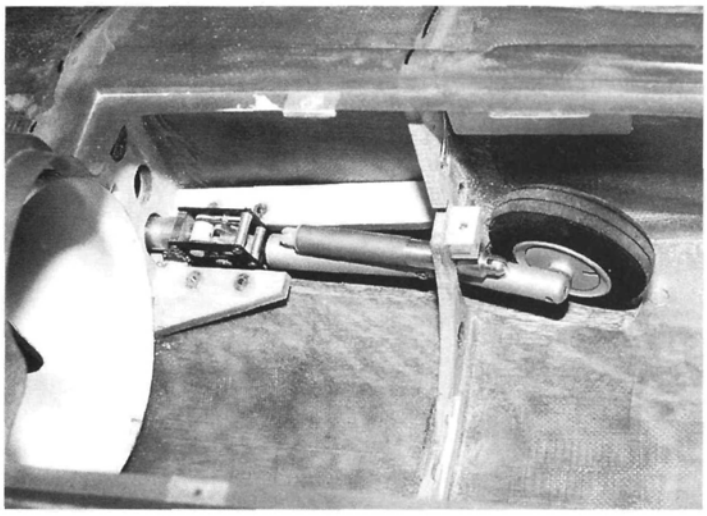




Above: the wing-spar bulkheads with fan and conformal fuel cells. The landing-gear plate is also visible on left of the Dynamax fan unit.

Left: two-piece tailpipe is shown with Dynamax fan and tuned pipe. Made to fit the F/A-18, the pipe emits exhaust to both tailpipe nozzles to give the effect of twin engines.

Below: the retractable Rhom-Air landing gear fits in the fuselage nicely; I only had to trim a small amount to allow the tire to clear on retraction.



The wings, stabs and fins come sheeted with the LEs already glued on, so there is little work here unless you opt for rudders, ailerons and flaps. As I mentioned earlier, I chose to install rudders, controlling each one with a separate servo in front of the stabilizer servos in the engine compartment. Because I decided not to use ailerons, I had to fill in the factory-routed area in the wing-core. I did this with a scrap piece of balsa sanded to match the opening and glued into place. I also closed the flap servo bay the same way; however, I needed to cut out a new one to accommodate the new location for the flap servo. I made this opening about 4 inches from the root of the wing at the thickest portion of the airfoil. Each wing houses a single servo that drives the LE and TE flaps simultaneously. I spent a lot of time to ensure that the two starboard surfaces moved exactly the same in relation to the port surfaces. When everything has been glued into place, it does take a bit of finesse to remove the conformal cells.

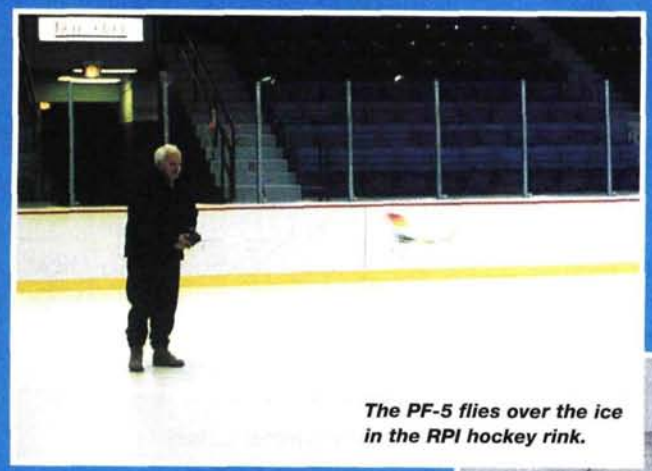
After all systems had been installed and checked for proper operation, I gutted the airframe and prepped it for finish. I first thoroughly washed all fiberglass surfaces with a solvent to remove any traces of release agent then sanded them with 320-grit paper. I sanded the balsa surfaces, filled any dents or defects and glassed the plane with ¾-ounce cloth. Because I chose a flat gray, low-visibility scheme, I decided to tint the K&B* white primer to the finished color, thereby eliminating the extra weight of several color coats. I next applied the markings, using the supplied generic ones that come on a pressure-sensitive sheet. For the markings that are unique to the color scheme I chose, I called Pro-Mark* to have paint stencils made. These act as a mask so that the markings can be accurately painted on. After completing the markings, I weathered the entire airframe and burned in rivets with a homemade tip in a wood-burning iron. When I was satisfied with the finish, I sprayed one coat of an automotive polyurethane clear to seal and protect it. An advantage of this auto clearcoat is that it contains UV blockers that will prevent sunlight from fading the finish.

As with most model jets, the project isn't complete until we get past the moment of truth: the first flight! My model weighed in at 14 pounds ready to fly—a bit heavy for a single-engine ducted fan. I consulted a few other modelers who had built and flown this design, and they assured me the weight was typical and that the plane would fly well. With my mind at ease, I made preparations for the test flight. I wasn't disappointed; this jet is as impressive in the air as it is on the ground. In conclusion, I am quite satisfied with the Hornet's performance as well as the taileron setup, and I would recommend this kit to anyone who's looking for a high-performance, scale model.

**Addresses are listed alphabetically in "Featured Manufacturers" on page 142.* ✈

MODEL AIRPLANE NEWS
FIELD & BENCH
REVIEW

Dave's Aircraft Works PF-5



The PF-5 flies over the ice in the RPI hockey rink.

Hoot 'n' holler flying with an easy-build, micro electric

by Dave Garwood

Electric flight is making a walloping resurgence with the introduction of great-flying little models, small, light powerplants, microservos, diminutive receivers and speed controls. Best of all, the new generation of electric slow flyers can be flown in truly tight spaces, including indoors, in a parking lot, schoolyard, or even in your driveway. One of these new electric park flyers, the Dave's Aircraft Works* (DAW) PF-5, is a remarkable design that incorporates loads of high-tech materials, makes good use of the latest in miniaturized radio and servo gear and delivers hoot 'n' holler flight time in a compact yet robust package. In addition, the solid flight performance and predictable flight characteristics of the PF-5 make it a candidate for training new RC pilots.

State-of-the-art onboard radio gear is crucial to successful micro flight, and with the guidance of Dave Sanders of DAW, I installed two Hitec* HS-50 Feather servos and a Todd's Models* DC-5 geared motor and prop with a 50mAh, 8-cell battery pack. Most amazing of all is the Sky Hooks & Rigging* RX-72 hybrid receiver that incorporates a motor speed control. This 3.5-gram device is a marvel of electronics engineering and production.

WHAT'S IN THE BOX?

The kit includes a fully assembled, gracefully curved EPP-foam wing with carbon spar already installed. The wing assembly is completely free of hot-wire hairs, the leading edge is fully shaped, and the wing tapers to a 1/16-inch-thick trailing edge.

The fuselage is a laminated balsa and carbon-cloth pod with a carbon-fiber rod fuselage boom. Lightening holes are predrilled, and the boom is mounted at the factory. The 1/16-inch balsa tail parts are precut and sanded; rudder and elevator hinges are installed at the factory.

The small parts bag includes 0.020-inch music-wire pushrods, Teflon tubing for the pushrod guides, heat-shrink tubing to hold the pushrod guides in place, more heat-shrink tubing for wiring insulation and plastic sheet stock for the control horns.

The 11-page, illustrated instruction manual discusses motor selection and suitable sub-microservos, receivers and speed controls. The manual thoroughly covers construction and setup for flight.

ON THE WORKBENCH

I began construction by studying the instructions and figuring out the wiring harness; by the time I got the trimming and soldering done, about two hours had passed.

The first building session included fitting the tail parts, test balancing, mounting the servos with Goop adhesive and spraying the wingtips with red Krylon. I was finished in an hour and a half.

SPECIFICATIONS

Model: PF-5
Type: electric park flyer
Manufacturer: Dave's Aircraft Works
Wingspan: 23.5 in.
Wing area: 195 sq. in.
Airfoil: NACA 6404/4404 (undercambered)
Length: 21.75 in.
Power system used: Todd's Models DC-5 w/gear reduction, WES-Technik* 9x5 carbon-fiber prop and 50mAh 8-cell battery pack
RTF weight: 4 to 4.6 oz. (review model: 4.2 oz.)
No. of channels: 3 (rudder, elevator, motor speed)
Radio used: Hitec Focus-6 FM w/two HS-50 microservos, and Sky Hooks & Rigging's RX-72 Hybrid receiver/ESC
List price: $64.95 (plus S&H)

Features: EPP-foam wing, balsa and carbon fuselage, balsa tail parts.

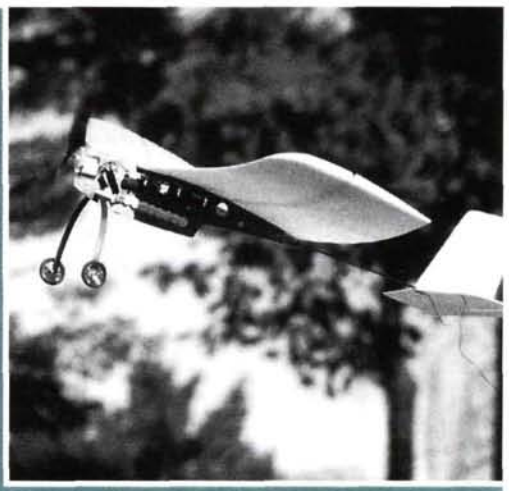
Comments: this model can easily be built in a few evenings and is a strong flyer. It's a great introduction to electric micro flight.

Hits
- High-quality kit components.
- Easy to assemble.
- Great flyer indoors and out.

Misses
- None.

FLIGHT PERFORMANCE

• TAKEOFF AND LANDING
The PF-5 has plenty of power for energetic ROG takeoffs. The procedure is to advance the throttle smoothly, begin the takeoff roll, hold heading with rudder control and ease back on the elevator stick to lift off. On a smooth surface, the plane lifts off positively in about 10 feet of takeoff roll. Landing is just as easy and controllable: reduce throttle to cut airspeed and fly a shallow approach until the wheels touch the ground, then cut the power. The plane will land without power, but its glide slope is steeper.



• LOW-SPEED FLIGHT
The PF-5 is designed to fly slowly. It will cruise at about 5mph while fully under control and will maneuver at this speed. It will demonstrate a gentle forward stall if flown too slowly and will produce a tip-stall if severely horsed around at very low airspeed. With the slightest attention to airspeed management, stalls are rare.

• HIGH-SPEED FLIGHT
The PF-5 will not fly much faster than about 10mph. After all, it is a slow flyer! At 3/4 or full throttle, the pitch and roll controls become snappier, as you would expect, and I did not notice a tendency for pitch to change as throttle settings were varied.

• AEROBATICS
Inside loops are solid with high battery power available early in the flight or with a brief preparatory dive to gain speed. Rudder rolls are possible with planning and experience at flying the plane. The polyhedral wing is not designed for rolling aerobatics, but it does give plenty of control for extremely close-in flying. This is perhaps the most amazing capability of the PF-5: you can have an entire 4-minute flight, and the plane does not get more than 50 feet away. I have also flown it in an indoor basketball court.

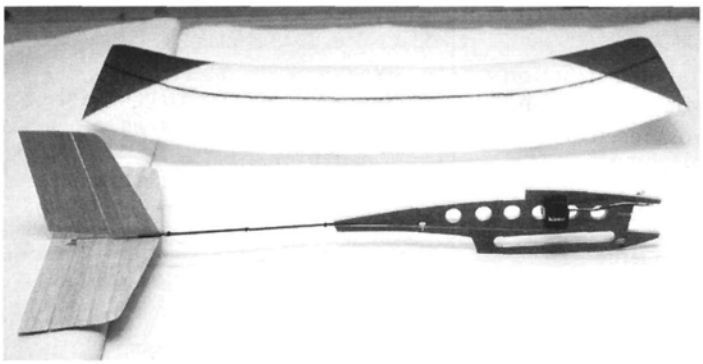
DAVE'S AIRCRAFT WORKS PF-5

In the second building session, I set up the control linkages, checked the balance again and decided to move the servos farther aft (to the position recommended by the designer!), installed the RX-72 receiver/speed control with Goop, installed the molded landing-gear struts with epoxy and sprayed the orange stripe on the wing. All this took two and a half hours.

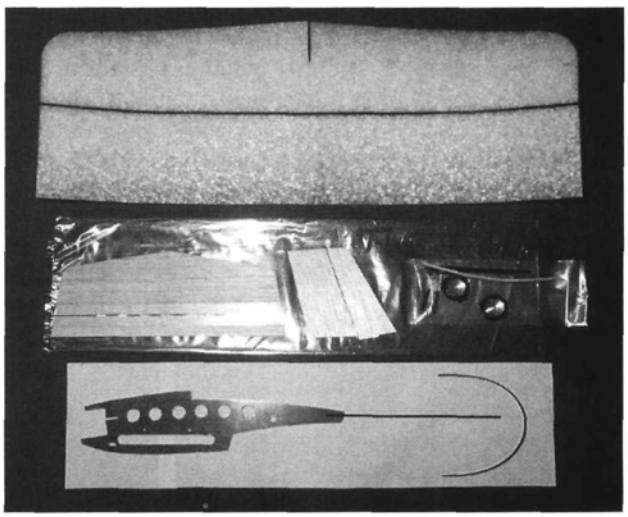
During the third and final building session, I used CA to mount the landing-gear axles and the wing, mounted the motor and propeller (both press-fits) and then did a final balance check and sprayed the yellow onto the wing. I finished in an hour.

Note that no wing finishing and little tail-parts finishing is needed; these are done at the factory. Construction time, including motor, servo and control-linkage installations, totaled 6½ hours and would have taken half an hour less if I hadn't had to move the servos. This plane could go from box to flightline in a day.

My completed PF-5 weighed 4.2 ounces—near the midpoint of the recommended weight range, thanks in large part to the light onboard components used throughout.

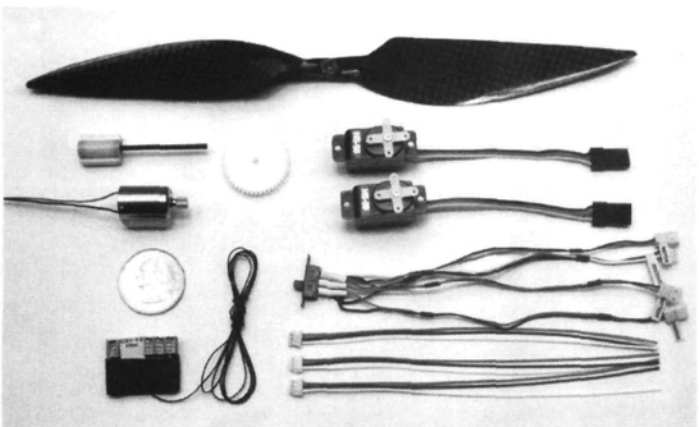


Above: after the first building session, I had mounted the tail parts and applied the first paint to the wingtips. Note that the servos were subsequently moved farther back than shown.



Right: the PF-5 kit contents: finished wing with molded carbon spar installed at the factory, tail parts bag with rudder and elevator hinged at the factory, small parts bag that includes wheels, balsa and carbon fabric fuselage pod with carbon-fiber tail boom installed at the factory, and edge-on view of the molded carbon landing gear.

Below: the components that make the plane go and control it: a WES-Technik molded carbon propeller and DC-5 motor with gear reduction (both from Todd's Models); a pair of Hitec HS-50 microservos; Sky Hooks & Rigging's RX-72 hybrid receiver/ESC, microswitch and micro connectors. The 50mAh 8-cell battery pack from Todd's Models is not shown.



FLIGHT REPORT

I first flew my PF-5 indoors in the Houston Field House hockey rink at Rensselaer Polytechnic Institute (RPI) in Troy, NY. My wife, Paula, drives a Zamboni there and was able to arrange some "ice time" for flight testing.

First was a high-speed taxi test to check control response and radio range and then a short 50-foot hop at 2 feet of altitude to check rudder and elevator response. Both were fine: snappy but not oversensitive.

Next was an ROG takeoff and climb to 15 feet, flying a racetrack pattern over the hockey rink. The plane climbs rapidly and positively and turns quickly and smoothly. When power to the motor is pulled back, it transitions well to gliding.

I flew four flights in the arena, each lasting from 3 to 6 minutes. It was a simple matter to keep the plane inside the confines of the Plexiglas barriers around the rink because it handles so well and, because it has plenty of power, the PF-5 easily climbed up near the 40-foot ceiling. The carbon-fiber landing gear and wheels worked well for both takeoffs and landings.

The next flying session was outdoors, over a snow-covered field in a municipal park. This time I launched by hand, and each flight started just fine. In the wide-open spaces, the low flight speed of the plane is more apparent; I'd estimate 7 to 8mph at ½ throttle. This time, the PF-5 climbed easily and was able to loop with a shallow preparatory dive.

Over the next two weeks, I flew the PF-5 once more indoors (in a gymnasium) and three more times outdoors, for a total of 17 flights. Outdoors, perhaps due to the slightly gustier conditions, I got flights lasting from 3½ to 4 minutes with the 8-cell packs. Seven-cell packs can be expected to give longer motor runs and a lighter wing loading.

Don't be concerned about the durability and crash-resistance of planes like the PF-5. Dave Sanders also makes tough foam combat and scale sailplanes, and he advised me, "The plane is too light to hurt itself in a crash, and if it does crash, the only things that will break will be parts you can fix yourself."

He's right; after a few pilot errors and subsequent hard landings, the repairs were minor and easily fixed with epoxy and CA. None of the expensive parts have been damaged.

Even my wife, who has put up with my model-airplane affliction since before we were married, has enthusiastically begun to learn to fly RC with the PF-5. The key to happiness here is a trainer cord, and I like the way the Hitec Focus 6 cables up to my Hitec Focus 4 for "dual-stick" flight instruction.

I've concluded that micro-electric flight is here to stay. The equipment is improving with each passing month, and you should not miss an opportunity to try this branch of the sport. Do not hesitate to select the DAW PF-5 as your first park flyer.

Addresses are listed alphabetically in "Featured Manufacturers" on page 142.

MODEL AIRPLANE NEWS
PRODUCT
REVIEW

Top-of-the-line computer control

JR PCM 10X

by the staff of Model Airplane News

The flagship of JR's* radio line—the highly versatile JR PCM-10X—will handle almost all RC aircraft. Many of its features are built in, and others can be programmed in, so it will serve its owner for a long time. This review explains many of the system's features.

We tested the 10X airplane system, which included a transmitter, a 10-channel PCM receiver, four 8231 digital servos, the airborne battery, a switch harness, accessories and a well-illustrated instruction manual—all in an aluminum carrying case. There is also a heli version of the TX.

One of the JR 10X's high points—and there are many—is the ease with which it may be programmed. All the steps are presented in a logical progression, and similar, related functions are grouped together in the menu to minimize the need to hunt around. The 10X's key feature is its touch screen—a big plus; it graphically interfaces all the features and adjustment commands and practically eliminates the need to read the manual; but do keep the manual just in case!

The 10X's LCD display when you turn it on. The digital display shows that the elevator has some up-trim, and the ailerons and rudder are neutral. To advance to the next screen, touch the Enter button in the upper right-hand corner.

THE TRANSMITTER

At 42 ounces, the transmitter has "heft" but is comfortable to hold. You can attach a neck strap to reduce fatigue during long flying sessions. The antenna is connected to a ball mount that allows it to be pointed in any direction; a shorter, base-loaded antenna is also available.

The 10X is available on all 72 and 50MHz frequencies (amateur license required for 50MHz). The transmitter is set up for JR's S-PCM and Z-PCM formats as well as for PPM/FM. The latter may be used for JR and aftermarket PPM receivers. (The 10X will not work with 627x, 629x and J229p receivers.)

On the upper right-hand corner are a knob for Aux. 4; a three-position switch for Aux. 2 that can also be used to turn on various mixes; the three-position aileron dual-rate switch; the three-position rudder dual-rate switch (the shorter of the two levers on the top); another mix switch; and on the side, a rotary slide-control that can be used for spoilers.

On the front and top of the TX, next to the sticks, whose length and spring tension can be adjusted, are seven toggle switches, a push-button switch, two knobs, what appear to be trim tabs and the prominent liquid-crystal display (LCD) that is the data-input device: you touch the screen with your fingers to enter commands and adjust features. This is very handy—no buttons! There are two rotary slide controls on either side of the radio where they can easily be moved by your fingertips. (We wish all radios had these.)

The aileron, elevator and rudder trim tabs are not the mechanical ones found on less expensive systems; instead, the 10X has "electronic trims." To change trim position, you push the trim switches one way or the other. The transmitter adjusts the trim position and beeps to indicate that the change has been made. If you continue to hold the trim adjustment, the beep changes pitch as you move farther away from center. The volume and tone of the beeps change as you move from one trim extreme to the other; at the trim center, you hear a much higher tone. The trim's present position is also shown on the LCD.

Many folks are hesitant about using this type of trim, but when you get used to it, you won't have to take your eyes off your plane to adjust your trims; you'll be able to hear the trim changes, and you'll wonder how you ever got along without such a feature. What's more, the transmitter remembers the trim positions of all your models, so having set them once, you need never worry about them again!

A plus for power pilots is that throttle control has a mechanical trim tab. The standard "ratcheted" trim has been retained to keep engine starting and shut-off familiar to the operator. Digital trim in this area would not be as practical as being able to physically move the throttle stick to the low setting while inputting full down-trim to shut off the engine. Similarly, using the low stick and high trim settings for engine starting also feels very natural.

On the upper left-hand corner are a knob for Aux. 3; a three-position switch for the takeoff/landing modes and the flap/aileron presets; the three-position elevator dual-rate switch; a push-button snap-roll control; the lever for the gear and a rotary slide-control that can be used for flaps.

PROGRAMMING

To test the system's versatility (or at least our programming

SPECIFICATIONS

Model: PCM-10X

Manufacturer: JR

Includes: 10-channel PCM transmitter and 9.6V 1100mAh battery (42 oz.); R-950S 10-channel PCM receiver (1.69 oz.); four DS-8231 digital coreless servos (88 oz.-in. torque; 1.73 oz. each); 1400mAh Sanyo airborne flat-pack battery; spiffy padded-aluminum carrying case; miscellaneous hardware: switch harness, battery charger, neck strap, antenna (stowed in the back of the transmitter case); Pilot-Link cable, DSC cord; 75-page manual.

Street price: $1,250

Comments: this high-end radio offers an extensive range of features and is highly versatile. It will serve its owner for a very long time, and its DataSafe and data transfer functions make it easy to store model settings on a PC 3.5 floppy disc and to download and email them as well.

Hits

- Lots of cool special functions: dual rates, exponential, throttle curve; flap-erons; elevons, four wing servos, servo-speed setting, gyro gain; Aileron—>Rudder, Elevator—>Flap and Rudder—>Aileron/Elevator mixing; landing flaps; eight programmable mixers; servo monitor display; model naming; data transfer.
- Flight modes provide different groups of settings in a single model memory.
- 10 channels; master controls can be disabled if needed for alternate functions.
- 10 model memories with names listed alphabetically.
- Electronic trims with beeps on three controls.
- Side slider controls.
- Large touch screen shows a lot and is easy to use for data input.
- DataSafe system allows storage of settings on PC.
- Comes with digital servos.
- Mechanical trim on throttle.

Misses

- Mixer programming has confusing channel-number labels.
- Manual has few examples of setups and complex programming.

On the right-hand back side of the transmitter is a switch for the right or left direction of the snap roll; the up or down switch is on the left side.

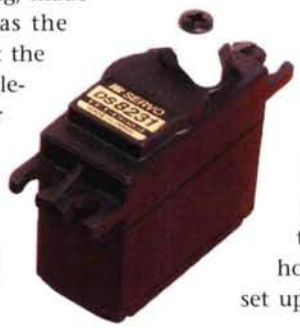
abilities!), We figured we'd try a fairly complex model setup. For this, we used a test model that has four wing servos, two elevator servos and rudder, throttle and auxiliary servos. We decided to configure the model to simulate an exotic fun-fly plane as follows:

- dual aileron servos, with ailerons programmed to work as flaps for tighter loops;
- dual flap servos, with each flap set up to work with ailerons for better roll;
- dual elevator servos, with each elevator servo also slaved to ailerons for hovering/torque rolls.

We connected the direct-servo-connect (DSC) cord to the TX and plugged the other end of the cord into the switch harness's charging receptacle. With power on, the TX commands the servos without emitting any radio signal. This is useful when making adjustments at home and in the pits when you don't have the frequency pin, and it helps to preserve the batteries because much less power is consumed.

We started by turning on the Quad Flap and Dual Elevator settings in the Wing Type menu (screen code 22). Quad Flap automatically slaves four servos (two outer surfaces as ailerons, two inner surfaces as flaps) to the aileron and flap controls. The manual shows the proper place on the RX to plug each servo into. The Dual Elevator function slaves a second elevator servo (Aux. 3) to the elevator channel. To get the two elevators moving in the same direction, we had to reverse the second elevator-channel (easy to do in the reversing menu).

Turning on the built-in Elevator—>Flap mixing function (screen code 63) makes the two inboard wing servos work with elevator for tighter turns and loops. Then we set up a programmable mixer for Aileron—>Aux2 (screen codes 51 to 55) which, with 50 percent mixing, made each flap move half as far as the nearby aileron. Finally, to get the aileron servos to respond to elevator input, we used another mixer with Elevator—>Gear. This is something to look out for and may seem confusing, as channel labeling isn't consistent in advanced mixing.



The JR PCM 10X comes with four DS 8231 digital servos.

The 10X is set up for the side slider to control the flaps. We didn't want this, so we disabled it using the Function Select menu (code 17). This function can be used to disable any of the knobs and switches so that their channels can be used for other things—handy when you're doing complex mixing.

Next came differential elevators: the aileron stick moves elevator no. 1 in the same direction as the aileron on its side and elevator no. 2 in the opposite direction. We used one of the programmable mixers with Aileron—>Aux3 that provided the differential motion required. Though highly specialized and definitely out of the ordinary, we completed our fun-fly programming in less than 10 minutes; needless to say, the 10X is highly versatile.

All the other standard programming features, i.e., exponential, dual rate (for aileron, elevator and rudder), servo-reversing, sub-trims, trace rates, servo speed and travel, snap roll, gyro function and throttle curve are equally easy to select and adjust.

FLIGHT MODES

The 10X can store flight modes. Each model setup can contain five sets of settings that can be changed by flipping a switch. You can set up a model for any flight regime you want.

Here's one way you could use the flight modes: for takeoff, you might want a little flap deflection, lots of rudder and aileron authority, gear down, rich mixture, etc. Once you've taken off, you could tone down the rudder and aileron travel, lean out the mixture, reduce idle speed, put the gear up, neutralize flaps but couple to elevator, etc. For knife-edge, you can automatically turn on the Rudder—>Aileron/Elevator mix function (code 64) so that you get roll- and pitch-coupling corrections automatically when you hold lots of rudder. You can also set up a condition for landing with flaps deployed and elevator trimmed with the flap-system function (code 66). You can also set up the 10X so that the trim positions are the same in all the flight conditions or so that they are independent of one another. The choices are limited only by your experience and your imagination.

WHAT ELSE?

The 10X has a lot more features that we simply don't have the space to cover; they include a data-transfer function that allows you to transfer model setups to another 10X system and a DataSafe system that allows you to copy 200 model settings to a 3.5-inch floppy disc or email/download them from a PC. A lithium backup battery that's soldered to the circuit board ensures that model settings are stored when the standard transmitter battery is removed for charging. Although this battery has a 5-year life, we recommend that you store all of your radio settings on a PC 3.5 floppy for safekeeping.

Also included are timer functions, digital trim-rate adjustment, Pilot-Link system (which transfers flight control to the student while leaving auxiliary functions and control rates with the master transmitter), multi-point programmable mixers, etc. In all, there are 34 screen key codes for the functions stored in the 10X.

As a top-of-the-line JR radio, the 10X is a marvel of computerized functionality and flexibility and is intended for the most demanding pilots. Its sophistication and well-thought-out programming, however, make it easy even for beginners.

**The address of the manufacturer featured here is listed alphabetically in "Featured Manufacturers" on page 142.* ✦

Left: the first page of the function numbers; e.g., if you were to press 11, you would go to the servo-reverse function. Right: the dual rate and exponential display for the ailerons in the 0 position. Under "D/R" are two readings of 100 percent. Moving the aileron stick to the right or left and pressing the plus or minus keys would change those percentages. The exponential percentages change together, no matter which way you move the stick.

MODEL AIRPLANE NEWS
ENGINE
REVIEW

by Vic Olivett and Bill Steffes

FOX MANUFACTURING 3.2

First in a new line of big-block gas burners

Fox Mfg.* has been around as long as most of us can remember. With its .35 engines for U-control and the newer, hot Quickie 500 engines, it has always been one of the hobby's leaders. When we flew U-control as kids, we always saw Fox engines at the flying field.

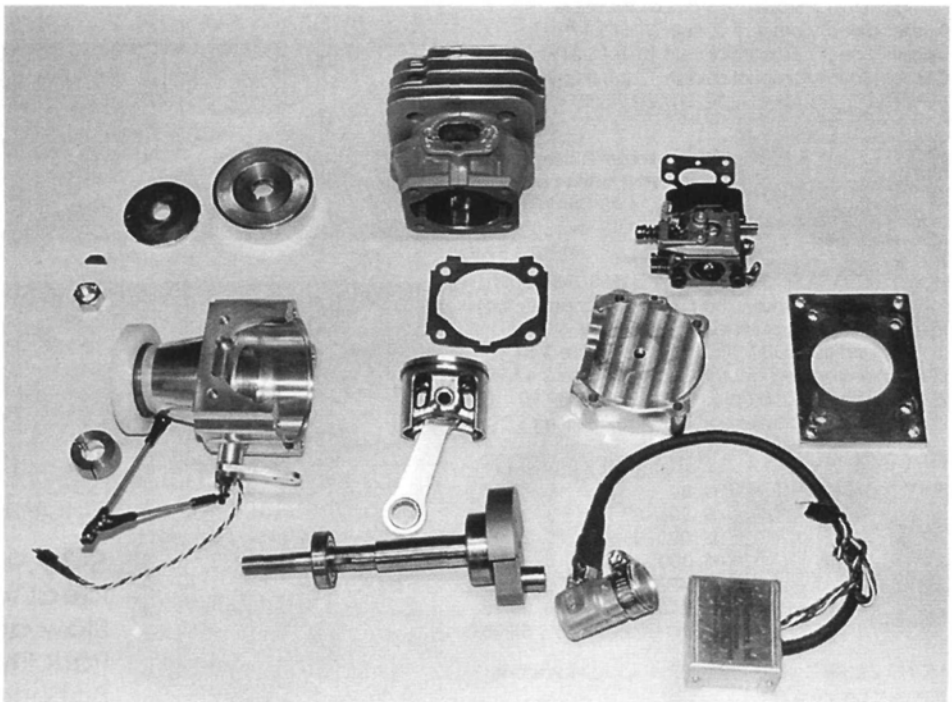
In 1952, Fox moved from California to its present location in Arkansas, and last year, it celebrated its 50th anniversary. Fox Mfg. has survived by staying on top of changes in the hobby, and now, under the watchful eye of plant manager Charles Thacker, it has jumped into the highly competitive arena of large gas engines, one of which—the new 3.2—is reviewed here. The new line also includes 2.4 and 4.2 singles, and 4.8 and 6.4 twins.

STATE OF THE ART

Our first impression was of the high quality of the engine's machine work. The top end—the cylinder, piston and connecting rod—are by Makita/Dolmar USA (the nicasil-lined cylinder has been bead blasted); but it is the lower end that sets this engine apart. Fox makes the crankcase and crankshaft. As the photograph shows, the cantilevered crank is a highly precise piece of machining. It is supported by front and rear ball bearings, and the connecting rod uses needle bearings. The rear plate has been drilled and tapped for smoke. Fox uses the Walbro WA76 carb; the spark is provided by a throttle-coupled spark-advance system with a C&H electronic ignition.

Like most modelers, we want to know how things work, so we dismantled the engine to look inside, and we asked our friend Ted Robinson to lend us a hand because he has many years of experience.

To our surprise, the engine was easy to break down: remove the four bolts on the backplate and the four holding the cylinder to the crankcase, and it's open for all to see. As we inspected the parts, we all remarked on the cleanliness of the

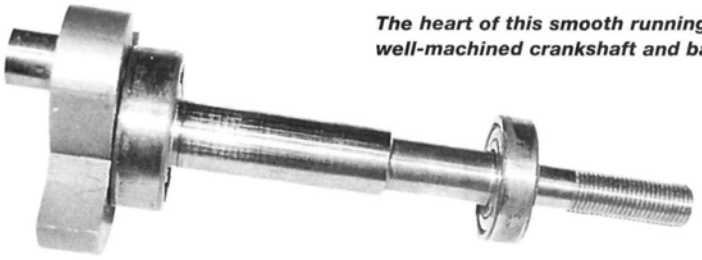


The disassembled Fox shows off the superb internal workmanship and quality of this mid-sized gas burner. C&H ignition is at lower right.

SPECIFICATIONS

Engine: Fox Mfg. 3.2
Type: gasoline
Displacement: 3.2ci (52.32cc)
Height: 6 in.
Length: 5.75 in.
Width: 5.25 in.
Weight: 3.5 lb.
Thrust: 26 lb.
Bore: 44mm
Stroke: 34mm
Exhaust: opens at 102°; closes at 257°
Port timings: open at 122°; close at 239°
List price: $549
Comments: this is a high-quality, exceptionally smooth running big-bird powerplant. It starts and idles reliably; run-up is smooth; and top-end power is impressive. It comes complete and has been run at the factory; has C&H Electronics ignition, spark plug and engine mounts; drilled and tapped for smoke.

interior, and we were curious about this because we know Fox runs every engine before it is shipped. When I asked Charles Thacker about this, he informed me that they use Klotz oil in the gas. This non-ash oil causes none of the usual carbon build-up on the top of the piston and spark plug. After reassembling the engine, it was time to mount it on our homemade test stand and see what it could do.

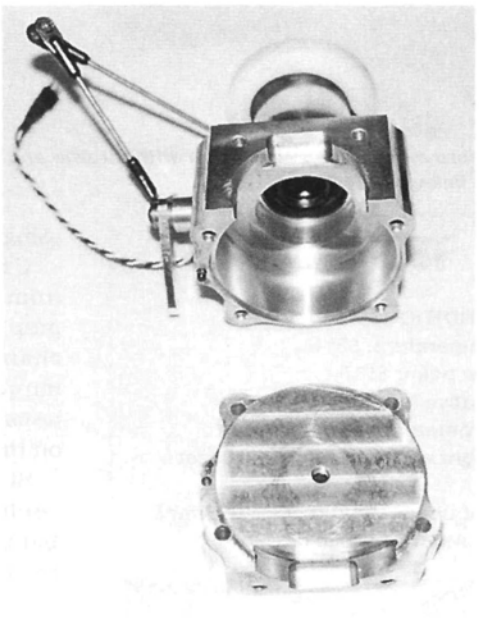


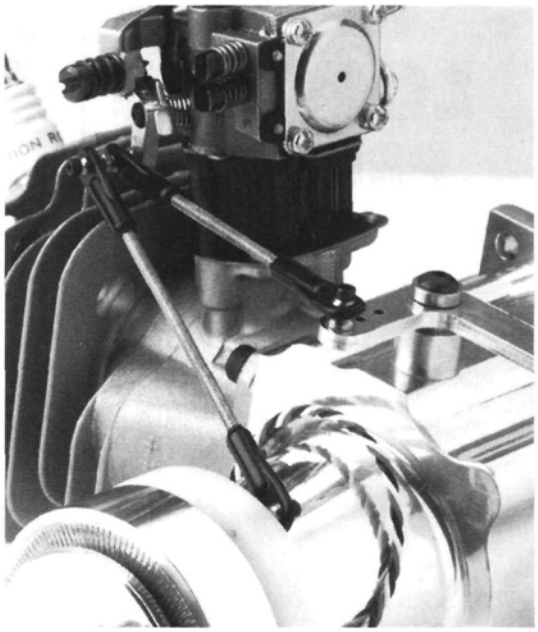
The heart of this smooth running Fox 3.2 is the well-machined crankshaft and ball bearings.

BREAK-IN

The mount is polished aluminum and has four predrilled holes. Having bolted it on the stand, we set up the fuel system and ignition. The C&H ignition uses a 4.8V pack, and for the first run, we decided to go with the Zinger 20x8 prop and a 40-to-1 fuel/oil mix. At the front, we used a Tru-Turn spinner (if you're going to use a spinner, go with the one of the best).

After a few flips of the prop, we powered the ignition and choked the engine, which popped with the next flip. We then opened the choke, and the engine started on the next flip! We commented on how





Left: the front and rear portion of the aluminum crankcase. Notice the rear portion of the case is tapped for a pressure smoke fitting. Right: the throttle and advance linkage with the sensor ring for the C&H electronic ignition.

GLOBEE INTELLITACH LCD DIGITAL TACHOMETER

A few months ago, Tower Hobbies sent us its new digital GloBee IntelliTach to evaluate as we did our engine tests. It has several neat features, and we used it extensively while testing the Fox 3.2. The IntelliTach can accurately read the rpm of 2-, 3- and 4-blade props from a safe distance, and its memory setting lets you store up to three readings for future comparisons. This is a particularly handy feature when you're testing different props, glow plugs and fuel.

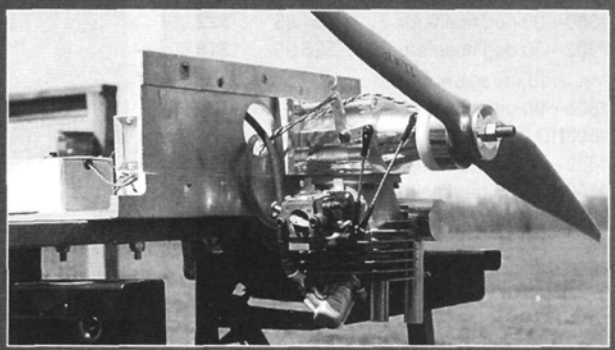
This little tach has a unique shape but is comfortable to use, and its large, high-contrast LCD is easy to read even in the brightest sunlight. The angle of the LCD screen can be adjusted to enhance its visibility.

The IntelliTach can read from 0 to 32,000rpm, and it runs on a standard 9V battery. If left unused for more than 5 minutes, it automatically turns off; how many times have we all left equipment on and allowed the batteries to run down?

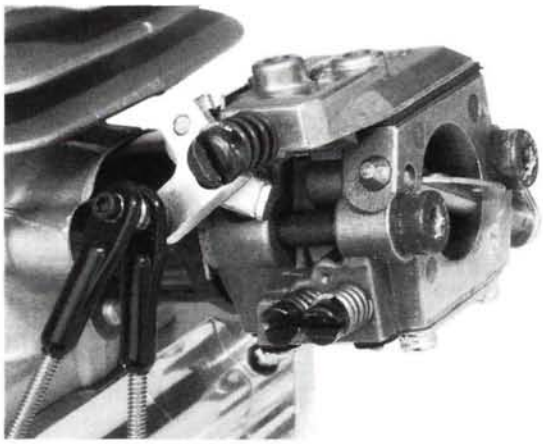
The IntelliTach's electronics are protected by a plastic case that we discovered is very durable; one of us (who shall remain nameless) dropped the tach about 3 feet from the test stand onto a concrete floor, and it wasn't damaged at all. We rechecked our readings and found that they did not vary from the originals.

If you are in the market for a reasonably priced ($34.99) tach that has several new convenient features, we are sure that you will be more than satisfied with GloBee's digital IntelliTach.

The Globee IntelliTach hard at work monitoring the Fox 3.2 during test/performance run.



The Fox mounted on the test stand takes a rest before the next run.



The Walbro model WA76 carburetor with throttle and ignition linkage.

TEST RESULTS

CONDITIONS
Temperature: 65° F
Dew point: 35° F
Relative humidity: 33%
Barometer reading: 30.27 in.
Height above sea level: 210 feet

Fuel used: Mobil regular w/Briggs & Stratton 2-stroke oil.

Prop	Idle rpm	Top-end rpm
■ **Zinger**		
20x8	1,750	7,920
22x6/10	1,590	6,460
22x10	1,680	6,400
■ **APC**		
20x10	1,740	7,920
20x12	1,700	7,560
22x10	1,620	6,910
■ **Forte**		
22x10	1,660	6,380

smoothly it ran: vibration was very low, and this struck us as a little unusual for a single-cylinder powerplant. After running through a few tanks of fuel at about 3,500rpm, we decided to do some testing.

BENCH TEST

We started with a Zinger 20x8. Yes, for this engine, this was a little under-propped/small, but we thought we'd start there and then explore the full spectrum of this engine's performance. We worked our way from the 20x8 up to a 22x10, using props by Zinger, APC and Forte.

Using the new GloBee tachometer from Tower Hobbies*, we tach'd each prop at idle and at top end. When we changed props, we were always impressed by the ease with which we restarted the Fox; it consistently started on the first or second flip.

All the props basically showed the same results: easy start, smooth clean run-up and good top end (we both remarked on the power of this little 3.2). Idle was always reliable, even when we pulled the throttle back farther then we should have. We had idle at 1,100rpm a few times—not something to rely on, but it was nice to see the prop turning so slowly.

TWO THUMBS UP!

The Fox 3.2 was designed for planes in the 15- to 26-pound range, depending on their design and type of flying. Our opinion is that we have here a well-designed, well-manufactured and easy to maintain engine for hobbyists who fly large aircraft. And the price is right.

We look forward to mounting this little gem on a model. In the next few months, we will test it further, and we'll also check out other engines in Fox's new gas-burner series. We can't wait to get our hands on one of the new Fox twins!

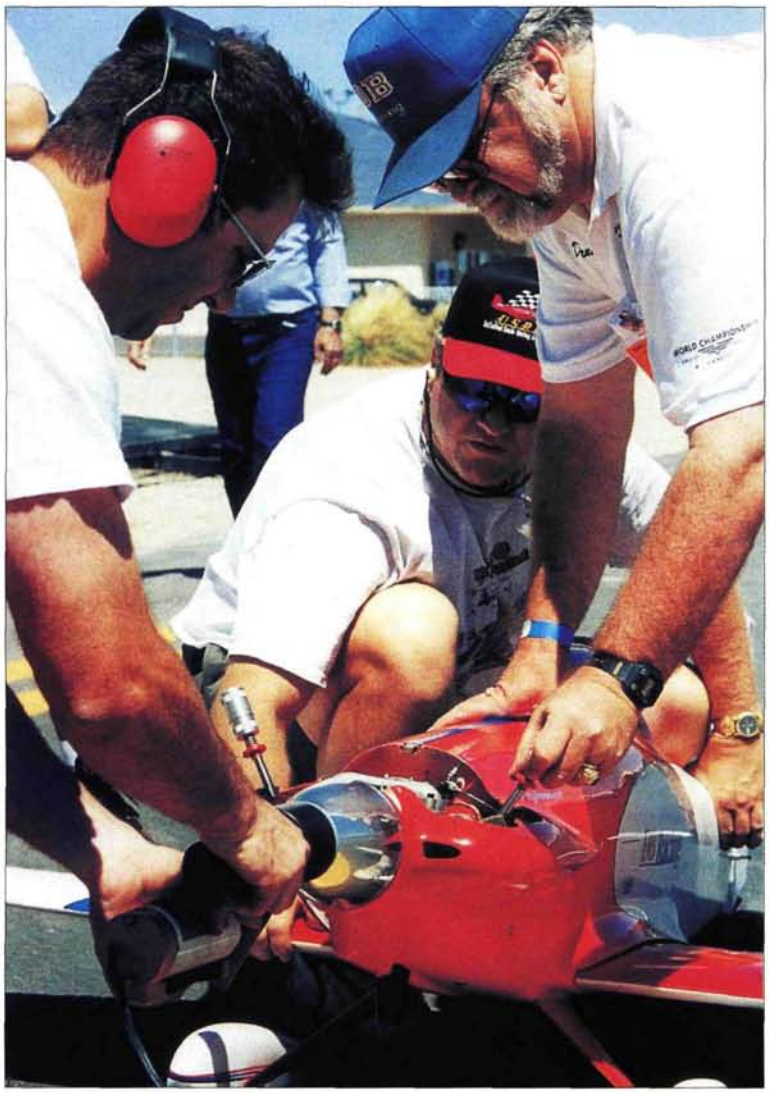
**Addresses are listed alphabetically in "Featured Manufacturers" on page 142.* ✦

The Fox reassembled and ready to mount.

GRASSROOTS *by Michael Luvara*

Reports from readers around the world!

Send in your event coverage. Mail photos, captions and text (500 words or less) to "Grassroots," *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606 USA. Color slides and prints are acceptable.



This colorful GR-7 is the handiwork of John Creagh of Bad Moon Racing.

It takes a dedicated crew to race a giant-scale model airplane. Here, members of the DB racing team work on their Zenoah 445-powered Cosmic Wind.

Silver State Unlimited in Jean, NV

In their workshops and garages, these modelers worked on building the perfect air racing machines. This past April, after countless hours spent constructing these extravagant models, they were put to the test as 62 of the fastest giant-scale RC aircraft in the world competed in the Silver State Unlimited in Jean, NV. Teams traveled from across the country to compete at the World Championship Air Races (WCAR), hoping to take home a cut of the prize money and fame.

Following the guidelines of the Reno Air Races, the field of competitors was divided into six racing classes: Biplane, Formula 1, Experimental, Unlimited, Thompson and AT-6. The Unlimited and Experimental planes were blisteringly fast on the straight-away at more than 220mph, while the AT-6s and Thompsons were clocked at closer to 140mph.

The race began with mandatory tech inspection of the competitors' models. Racing was slated to begin on Thursday afternoon but was delayed until Saturday because of poor weather and 50mph wind gusts. Nevertheless, race promoter Archie Snider and his dedicated race crew managed to complete five rounds of racing plus the trophy races in two days—a testament to how smoothly the event was run.

PHOTOS BY MICHAEL LUVARA

Left: a racer on landing approach with a turn pylon in the background. Note the lights that let the turn callers know when their planes have passed the pylon. Right: Blue Moon Racing's Mong brings another new face to the racing circuit: pilot Terry Williams flew this biplane to a fourth-place finish in his first race.

Oops! This Thompson Trophy-class Gee Bee is caught with its pants down—wheel pants, that is.

Above: Rick Schrameck of Quick Turn Racing built this RnR Sundancer bipe. Right: this Zenoah 445-powered Gr-7 is the handiwork of the Bad News Racing team and was piloted by Tom Rainwater. Teams get very creative with race slogans; this team sports the catchy line, "Bad News Travels Fast."

Right: Ken McSpadden's Aerosport T-6. All T-6s are kept to stringent airframe minimums and must use stock G-62 engines to ensure equality.

When the dust settled after the trophy rounds, the victors were awarded with trophies and a portion of the purse. The pilots who competed in Jean accumulated points that count toward the World Championships, and races in Ohio and Texas during the summer will also help to determine who will be the series winners at the end of the year. The racing is close in all of the classes—especially Formula 1, in which the top competitors were separated by mere seconds. The overall champions will not be known until the last lap of the last race in the fall.

SPONSORS

- A3 Performance Engines
- Aerosport
- Airtronics
- Bob Smith Industries

Jouster II

A high-performance sport sailplane

by Harley Michaelis

The original Jouster was published in 1993. It was such a joy to fly that I built 22 of them before going to the Genie—a stretched, 12-foot vacuum-bagged version. Because the Jouster handled and performed so well, I thought it was time to offer a more refined version. Among a few dozen changes are a lower fuselage profile, revised wing planform that uses a blend of Selig thermal airfoils, a revolutionary new, all-internal way to move surfaces and a rugged yet simple composite spar system to better handle spirited launches and zooms.

Precut wing-cores are available. Low-tech construction requires common tools and simple techniques. In its simplest form, as detailed in the plans and building text, the wing can be balsa-skinned and covered with film or glass. Obechi can be used with other finishing techniques. If you have vacuum-bagging equipment, carbon fiber and glass cloth can be directly attached to the cores for the slickest, highest-performing version. In any version, however, the Jouster II's easy handling and fine performance make it an excellent choice for sport flying or traditional thermal competition. Jouster II has a host of unique, practical features not found in typical contemporary kits or ARFs. Let's take a walk around it.

SPECIFICATIONS

Model: Jouster II

Type: sport sailplane

Designer: Harley Michaelis

Wingspan: 120 in.

Wing area: 1,038 sq. in.

Aspect ratio: 13.87:1

Weight: 67 to 70 oz.

Radio req'd: 6-channel (aileron, stabilator, rudder, flaps) w/6 servos

Comments: the Jouster II is a high-performance, sport sailplane that uses a unique rotary drive system for control. The fuselage and tail are balsa and plywood, and the three-piece wing is sheeted foam. Jouster II is relatively simple to build and flies well. The plan comes with detailed instructions, materials list and list of commercially available accessories, including foam wingcores.

PHOTOS BY HARLEY MICHAELIS

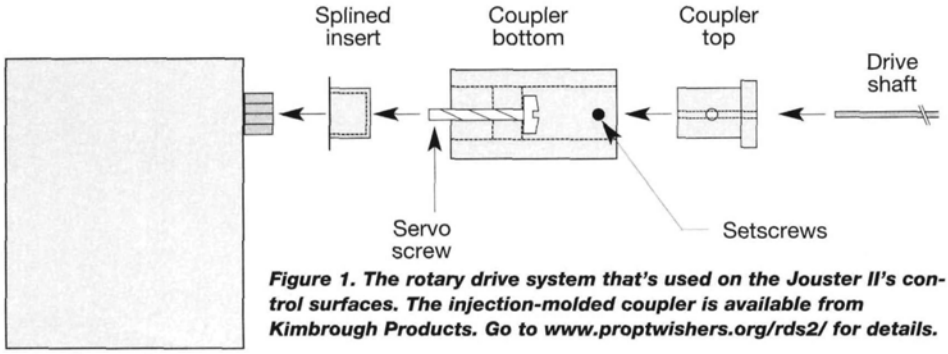
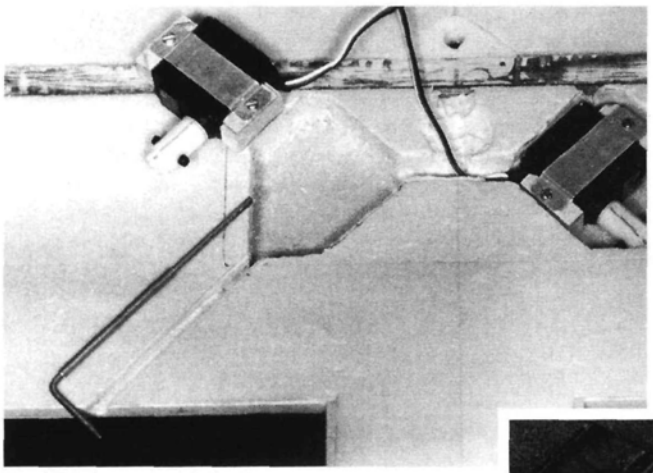


Figure 1. The rotary drive system that's used on the Jouster II's control surfaces. The injection-molded coupler is available from Kimbrough Products. Go to www.proptwishers.org/rds2/ for details.

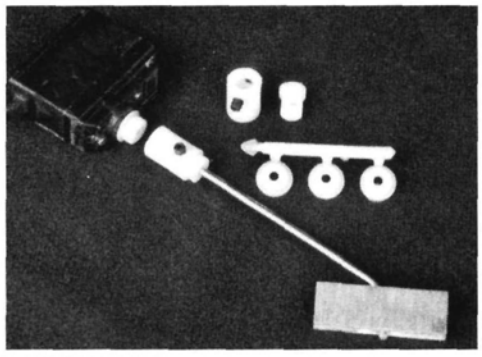
ROTARY DRIVER SYSTEM

The Jouster II uses a new, all-internal no-slop method—the "rotary driver system" (RDS)—to move its hinged surfaces (see Figure 1). No horn, clevis, threaded rod, output arm, etc., is involved; and nothing hangs out to cause clutter, drag, or noise, or to catch on things. Working parts just slip together. No pushrod pulls at right angles to the output gear, so the system is easy on servos. The injection-molded coupler used in this system is available from Kimbrough Products* and comes in three parts. The provided splined inserts adapt to the splined output gears of virtually all popular servos. The drive shaft enters a pocket that's embedded in the moving surface, and a bend in the shaft by the hinge line causes the surface to deflect as the servo rotates.



The fitting on the flap servos is the Kimbrough Products molded coupler that's used to install the RDS. Servos are snugly mounted between rails on bases of 1/32-inch ply. A 2-inch-long brass tube on the shaft is epoxied into the channel to align the shaft from coupler to pocket and to properly position the servo base. The base is then secured with epoxy putty. Setscrews secure the shaft. The construction text that comes with the plans fully details all of these steps.

With RDS, servos are best firmly bracket-mounted between rails on a ply base. Aileron servos are placed near the ends of the center section of the three-piece wing. The shaft protrudes and slips into a snug, reinforced slot in the aileron. The shiny dot right of the servo cover (cut out of the skin) is the setscrew that enters the notch in the blade.



The RDS package includes splined adapters that fit Airtronics, JR, Multiplex, Hitec and Futaba standard-servo output gears. The Airtronics 94141 is shown. The larger section of the coupler fits over the adapter. The servo screw secures the assembly. Setscrews join both sections and secure the drive shaft. The shaft slips into an embedded pocket made out of Formica and wooden spacers. As the servo rotates, the surface is deflected.

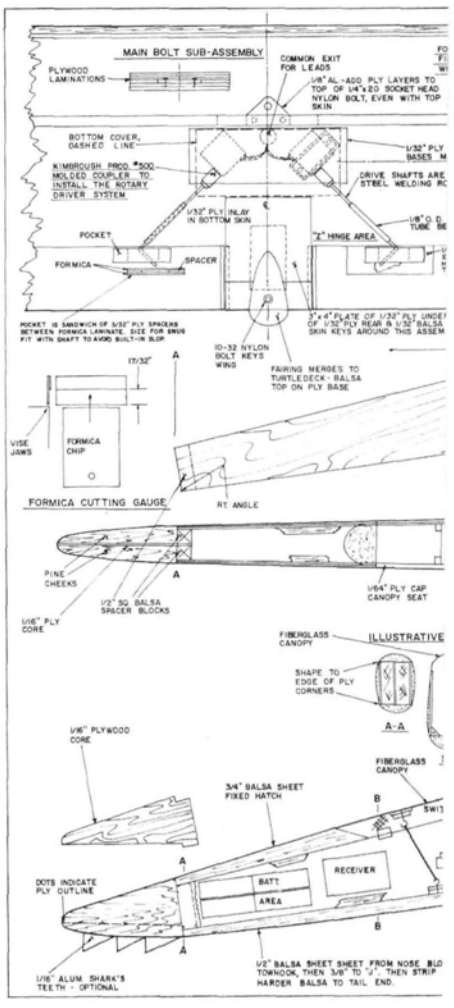
THE WING

Jouster II has a three-piece wing that's firmly secured for flight by nylon bolts. In a hard enough dork, though, these bolts will shear and allow the wing to slip forward, displace the canopy and rotate away. In numerous incidents over 10 years with my 22 Jousters and 17 Genies, I've only had to replace bolts to resume flying.

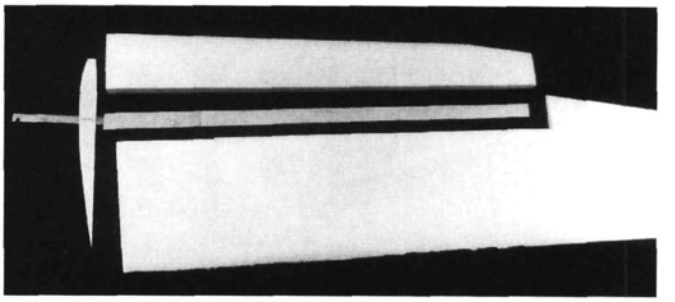
Detachable tip sections, built light for bang-bang roll response, are supported by well-anchored, blue "clock-spring" steel blades that positively lock on, eliminating tape. The receptacles for the blades and the 60-pound-density Foamular used for vertical webs are sandwiched between 0.060x3/8-inch carbon-fiber spars. The assembly is wrapped with Kevlar thread and provides great resistance to compression.

Aileron servos go just inboard of the center-section ends, eliminating the need for outboard connectors. Uniquely, the RDS drive shafts slightly extend from the center and automatically engage slots in the ends of the ailerons as tips are locked on.

The center-section airfoil is SA7036. It progresses to SD7037 midway on the tip and then on to SA7038. This blend



provides aerodynamic washout and fine thermalling capabilities. With other field-proven design elements, the result is an easy-handling airframe that performs especially well in all categories for traditional thermal competition.

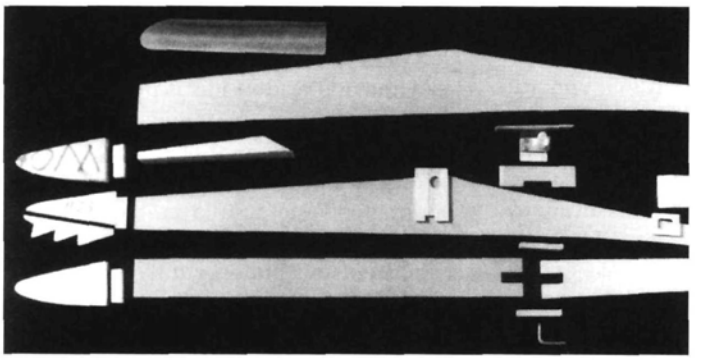


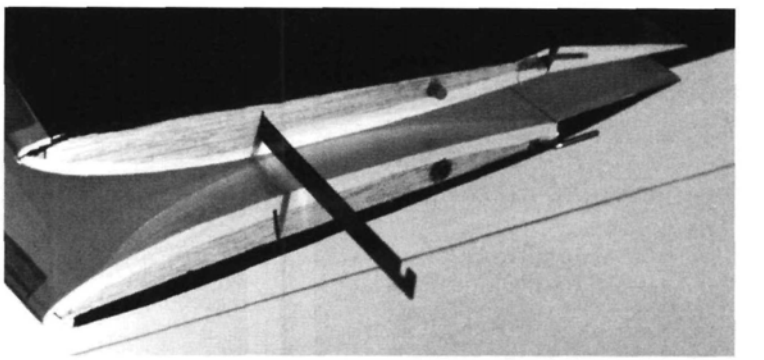
The tips have a vertical spar to which a steel blade is permanently secured. The blade boxes have threaded inserts that guide a setscrew into the notches in the blades.

THE FUSELAGE

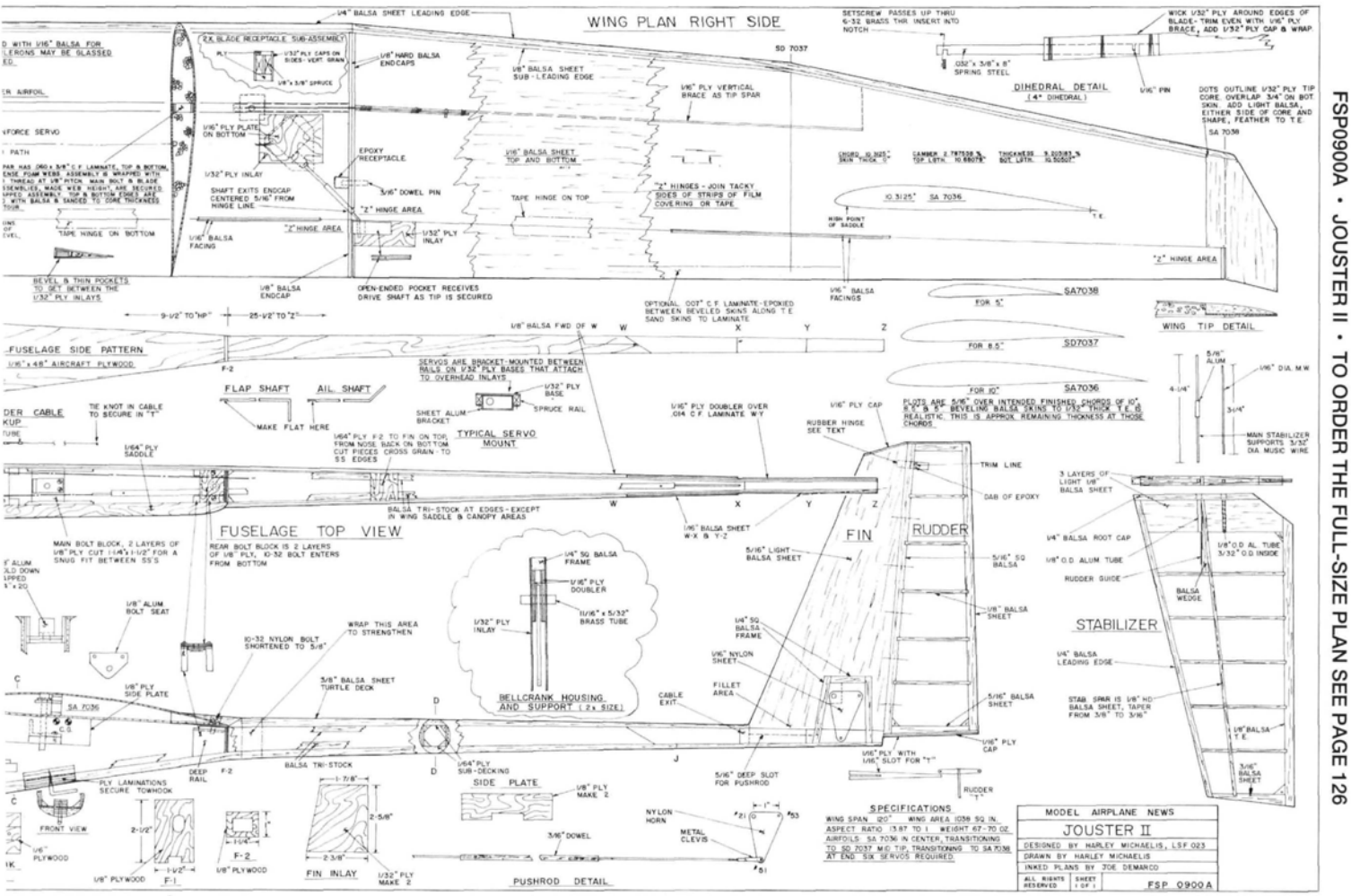
The slim, curvy, lightweight, resilient, aesthetic and surprisingly durable fuselage is made of wood and is quite simple to build, glass and paint. The construction notes that come with the plan detail it all. The pronounced "droop snoot" helps you to pick out the ship in a gaggle of sailplanes, prevents flaps and tips from dragging and puts the nose down first without "spearing." The optional shark's-teeth skid digs right in to brake landings.

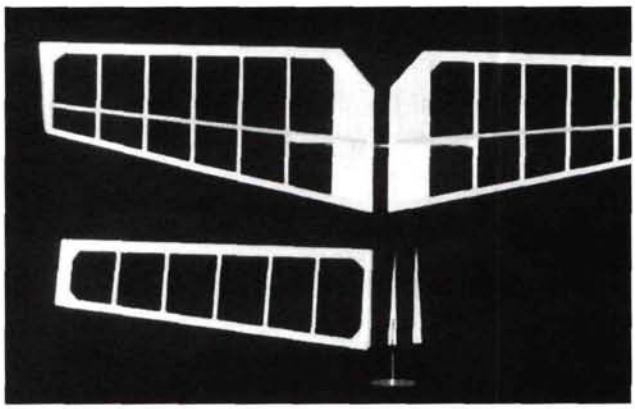
Rudder and stab halves are simple, light, built-up balsa structures. With the long nose, balancing out is easy. Pull/pull cables cleanly operate the rudder, which can be hinged with flat latex Harley's Hinges* for a butt fit. Pieces of this rubber in the stab structure provide a friction grip to help retain the halves in flight.





Left: the fuselage parts. Right: the RDS drive shaft protrudes from the center section. The shaft automatically links into the snug, reinforced slot in the end of the aileron as the tip is attached. Because the aileron servos are in the center section, no long leads are needed, and this simplifies assembly.





Tail pieces are simple, built-up structures. Wedges on the stab spars have flat surgical rubber attached for a friction grip with the main stab support wire. The rudder bottom has a capped, slotted ply piece to retain the T-cable fastener.

Building a Jouster II affords an opportunity to revive or develop building skills. With a full-size, well-detailed plan, thorough, step-by-step construction text, cores, spring-steel blades, molded canopy, hardware and wood packs available, the project is feasible for even less-experienced builders.

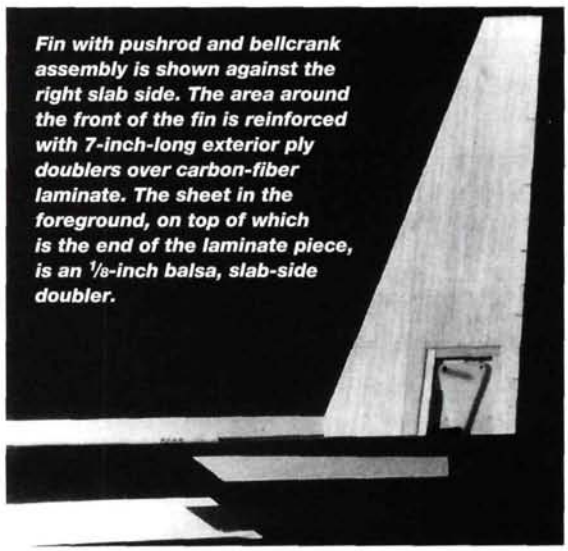
CONSTRUCTION

Compete building instructions, including glassing and painting the fuselage and flight setup details are included in the instructions provided with the plan, along with lists of the materials, foam cutters and the commercially available parts. Those online can check out www.proptwisters.org/jouster2. This website also includes a supplemental set of instructions for a vacuum-bagged, carbon-fiberglass layup directly on the cores.

AT THE FIELD

Hand-glide and trim the stab as needed. Initially, tow it using a forward towhook position and without down-flap. Expect a shallow tow. At this stage, the objective is to safely seek a balance point and stab trim that results in a comfortable self-recovery rate from a dive. At safe altitude, put the model into a shallow dive, hold it to build speed and let go of the sticks. If you are comfortable with minimum self-recovery, gradually balance farther rearward and retrim the stab until it barely pulls out on its own. This gives a normal cruising attitude where the ship moves at a good clip and at a 2- to 2½-degree angle of attack. This helps give good penetration and crisp response to control input. Note that response to elevator (stab) input gets more sensitive as balance is moved rearward. Learn to ignore the droop snoot. Cruising, the aft portion of the fuselage should be about parallel to the ground or appear to be slightly diving. Let the model bore in and fly at higher cruising speeds rather than hang on the point of stall and flounder around. When you're satisfied with the balance, remove the wing and mark the "wing off" balance point on the saddle. Remove any external lead and add lead inside as needed to balance the wing at the marked "wing off" balance point. Lead shot can be secured inside, flush against the nose blocking, by pouring polyester resin over it.

To find the best towhook position, let winch tension build or fully stretch the high-start (without flaps). Throw aggressively to get all possible airspeed. Get the nose up by pulling up-elevator if needed. Incrementally move the towhook rearward until the ship is on the fringe of getting squirrely. If flap servos allow play, use a little flap reflex at higher speeds to avoid buzz. If you hear a buzz, it may be caused by loose rudder cables that seem to stretch at first.



Fin with pushrod and bellcrank assembly is shown against the right slab side. The area around the front of the fin is reinforced with 7-inch-long exterior ply doublers over carbon-fiber laminate. The sheet in the foreground, on top of which is the end of the laminate piece, is an 1/8-inch balsa, slab-side doubler.

Readers should feel free to contact me c/o *Model Airplane News*, or email me directly at hmlsf023@bmi.net with any questions. I hope you enjoy the Jouster II as much as I do.

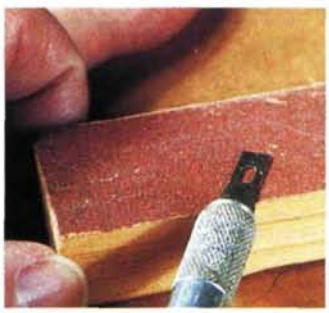
**Addresses are listed alphabetically in "Featured Manufacturers" on page 142.* ✚

Make a simple trim cutter

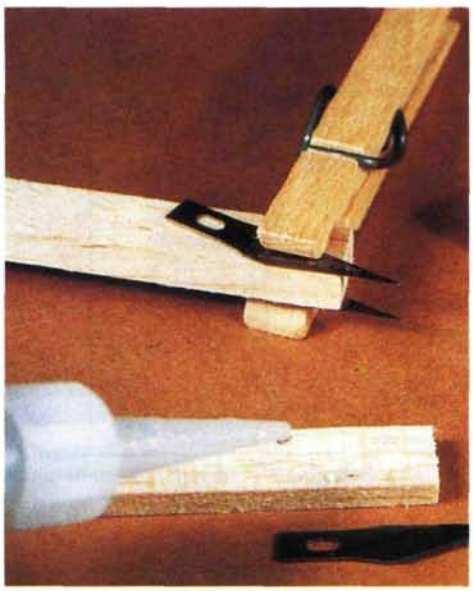
Quick and easy pinstriping by Randy Randolph

Almost every trim scheme has a pinstripe somewhere. Some are thin and are used to form contrasting outlines around letters, numbers, windshields and windows; others are wide or flowing. It's easy and very inexpensive to make a tool that you can use to cut all of these shapes out of plastic covering material. The photos show how to do it.

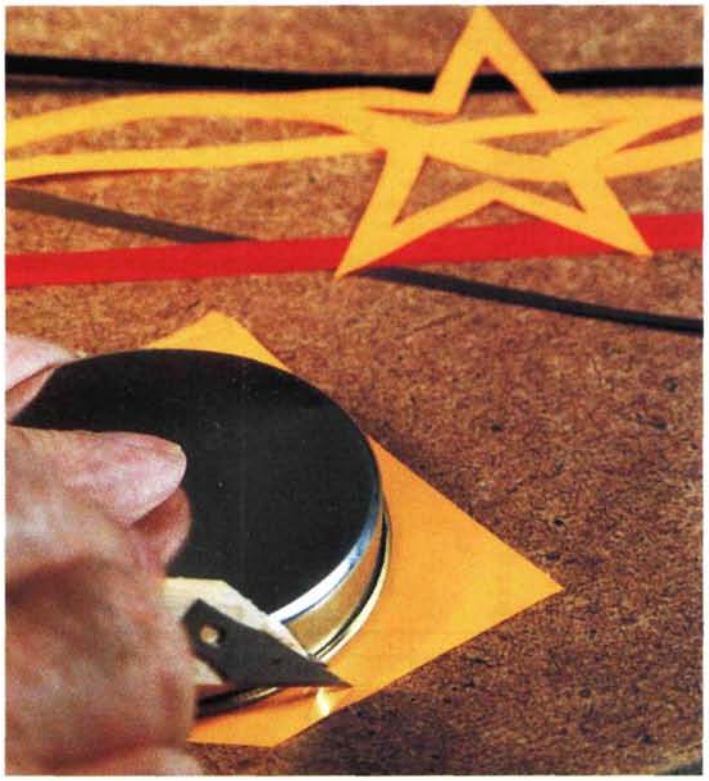
1 The basic materials you'll need are two no. 11 hobby blades, slow CA and a piece of hard 6x1/2-inch balsa that's as thick as you want the pinstripe to be. If you want 1/16-inch-wide pinstripes, plywood works better. The first step is to remove any oil or grease that may be on the hobby blades. A paper towel and some rubbing alcohol work well and leave no residue on the blades.



2 Insert each no. 11 blade into a handle, blade end first, and rub the base of the blade on a sanding block to slightly roughen each side. This give the sides of the blade some "tooth" so the CA can better hold the metal in place.



3 Glue one blade on each side of the wooden handle, with the pointed end about 1/4 inch forward of the end and flush with the bottom edge. Be sure both blades extend forward the same distance and are flush with the bottom of the handle. Use slow CA so that you can adjust them if necessary. When the CA has cured, trim the front of the tool to match the blades.



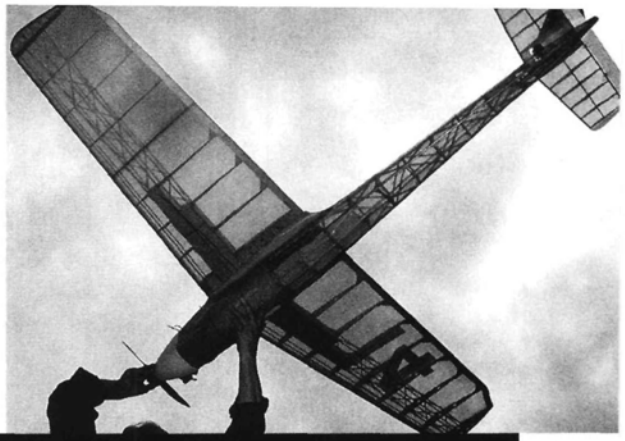
4 You can cut simple pinstripes using a straightedge as a guide. All stripes will be the same width as the tool, so matching is easy and accurate. Odd shapes, such as circle and star outlines and wide, curvy lines, can be cut around templates. It is important to hold the tool so both blades cut the film at the same time.

5 Simple outlines become interesting trim with little effort. I made these star outlines with an 1/8-inch-wide tool and spent more time ironing them in place than making them! +

PHOTOS BY RANDY RANDOLPH

by Maynard Hill

Make easy, light wing fillets

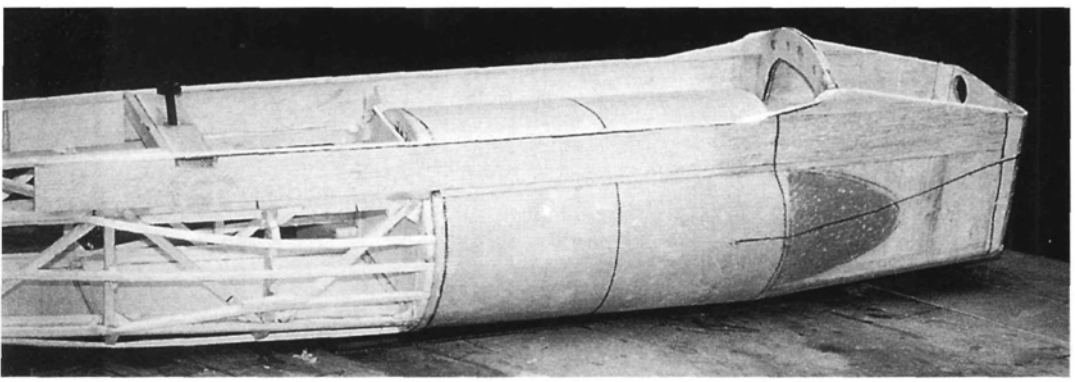


Foam and fiberglass construction

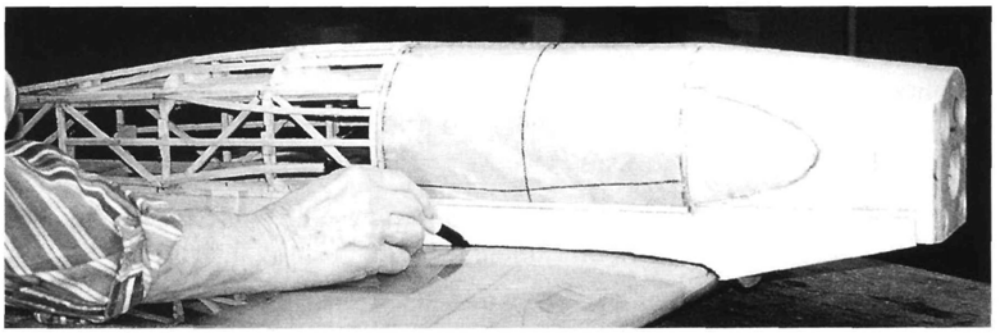
Wing fillets not only look good, but they also decrease drag and help airplanes to fly faster; for example, Marvelous Martha, which I've used to set five world distance records, flew at 67mph at full throttle without wing fillets. After I had added fillets of the type described here, Martha flew at 70mph at full throttle. When I was racing against sunset to set a distance record (808 miles), this 4 percent increase in speed was welcome indeed!

Stunt models, pylon racers, soaring gliders and other types of model can be improved by adding wing fillets, but installing them can be problematic. Balsa planking on curved formers is one technique, but it is time consuming and complicated; using a mixture of epoxy putty and fiberglass microballoons is another, but it's messy and makes heavy fillets.

The photos show a relatively easy way to make light, graceful fillets using foam insulation.

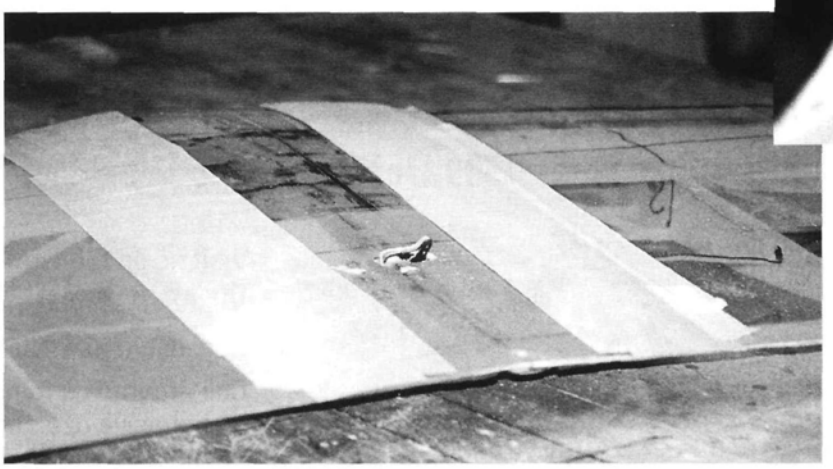


1 Here's the bare wing saddle on an airplane I call "TAM-10." TAM stands for "transatlantic aero model" and "10" means it's the 10th fuselage I've built for the project. The round cylinder in the middle is a built-in fuel tank that holds about a gallon. Note that the wing is held down by a 3/8-inch dowel at the front and by a 1/4x2-inch nylon bolt at the rear. The wing center chord is 18 inches.



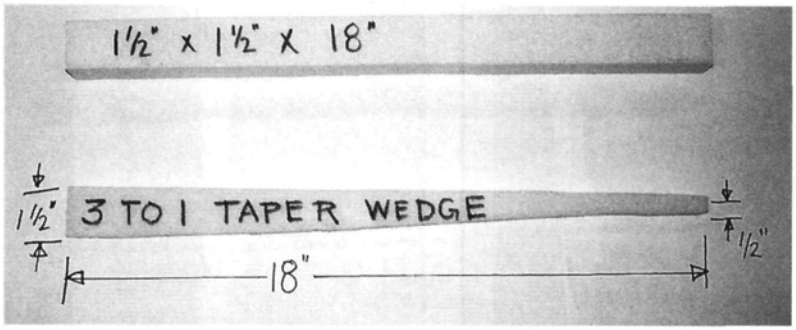
2 Bolt the wing on, turn the model upside-down, and trace a line on the wing on each side of the saddle.

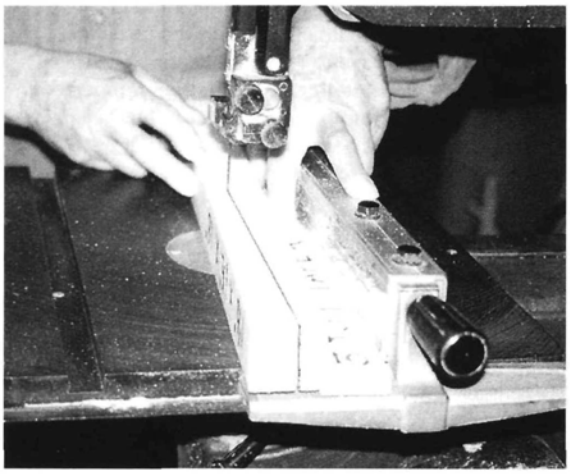
3 Take the wing off and tape strips of 1/64-inch-thick birch plywood to its bottom surface. Position the strips so that they cover the saddle trace lines you drew at the edges of the saddle and extend approximately 1/2 inch inboard of the saddle. The strips shown here measure 3x18 inches and have been taped only on their outer edges. Note that the plywood extends about 1/8 inch beyond the trailing edge.



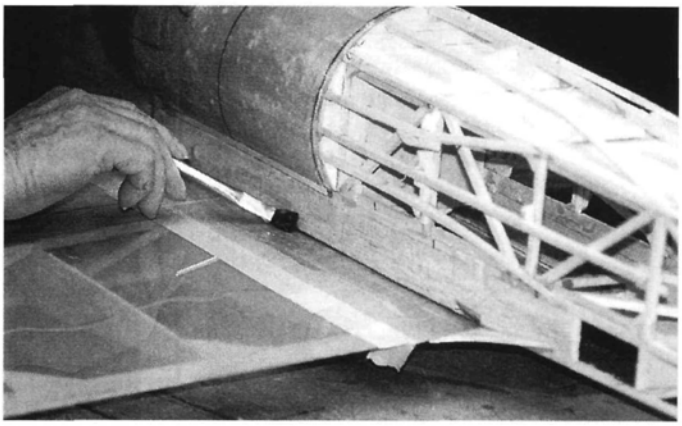
4 Bolt the wing back on the fuselage and add the curved web plates. Tack the plates to the 1/8-inch lip at the trailing edge and also to the fuselage side. In this case, the web plates are angled downward to extend the top of the airfoil.

5 Now cut triangular pieces of pink or blue foam insulation. The foam weighs 2 pounds per cubic foot and is available in 2-inch-thick, 2x8-foot sheets for about $3 a sheet. Decide how wide you want your fillet to be at its trailing and leading edges. My magic number is a 3:1 taper, for example, 1½ inches wide at the TE and ½ inch at the LE. Cut a tapered piece to use when you guide the 1½-inch-square piece of foam through your band saw.

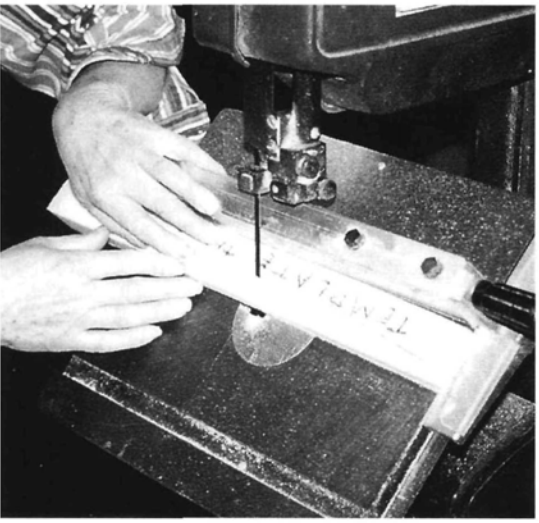




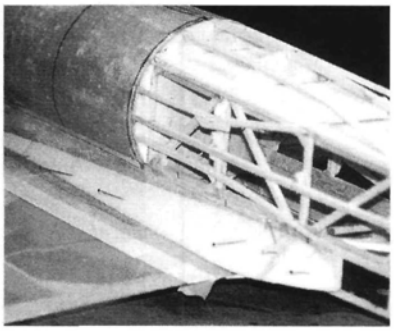
6 The tapered guide is used to cut a taper on the 1½-inch-square foam. The sawn cut line has been enhanced to help you see where the blade has been. Now flip the piece over and repeat the guided, tapered cut.



9 Turn the model upside-down and coat the area where the fillet will go with thin epoxy. I use West System* 105 resin and 205 hardener. When you epoxy this area, the epoxy will seep into the joint.



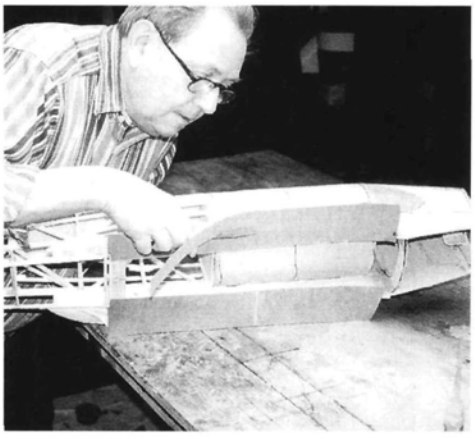
7 Don't move the saw-guide fence. In this case, it is 2 inches from the blade—the same distance as when you cut the tapers. Now tilt the saw table to 45 degrees and, again using the tapered template, saw the piece in half lengthwise. You now have two identical tapered pieces with triangular cross-sections.

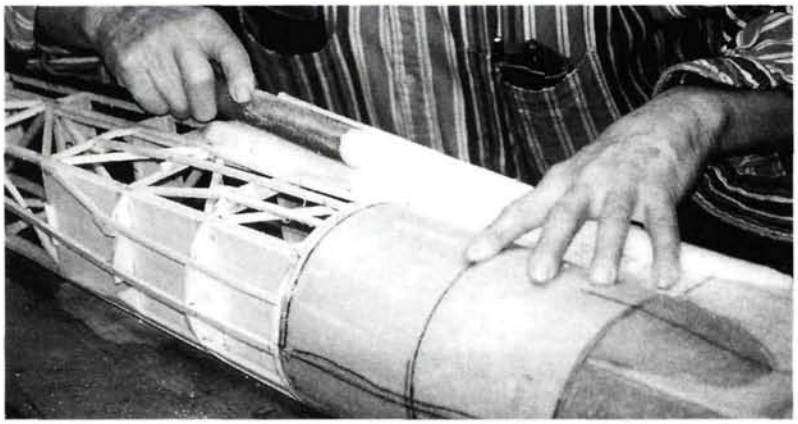


10 Epoxy the inner mating surfaces of the tapered foam pieces, then push them into place and use pins to hold the assembly while the epoxy cures. Also, pin the small triangular pieces into place on the tail webs. Let the assembly dry completely; you want the epoxy to be rock hard before you proceed.

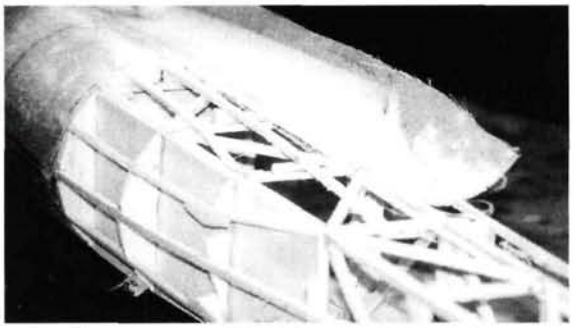
8 Because the high-wing TAM has hardly any dihedral, I used a sanding block to shave off a little foam. There's no need to be super precise. It follows that if you are making a low-wing model that has dihedral, you will have to make the angle less than 90 degrees.

11 Use a scissors to cut off the excess plywood, then use a sanding block to smooth the jagged edge flush with the outer foam line.

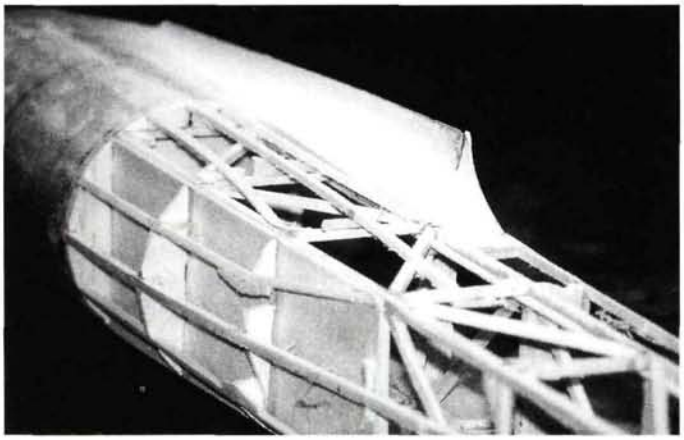




12 Make a round rasp file by using contact cement to attach 60-grit sandpaper to a short piece of 1-inch dowel. Using only light pressure, stroke the foam to sculpt the fillet curve you want into the foam.

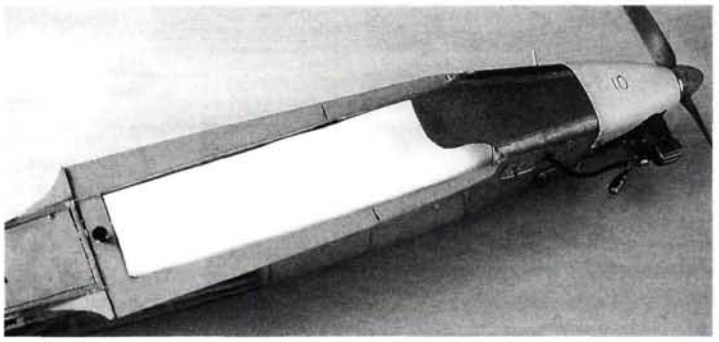


14 Paint the fillet with epoxy resin and lay glass cloth on its curved surface (2-ounce cloth works well). Thoroughly soak both the foam and the glass cloth with resin, then remove the excess resin by laying paper towels on the surface (you don't want hardened epoxy rivulets in hard-to-sand places).



13 Fair the fillet to blend smoothly into the fuselage and the saddle lines. The final shape should look like this.

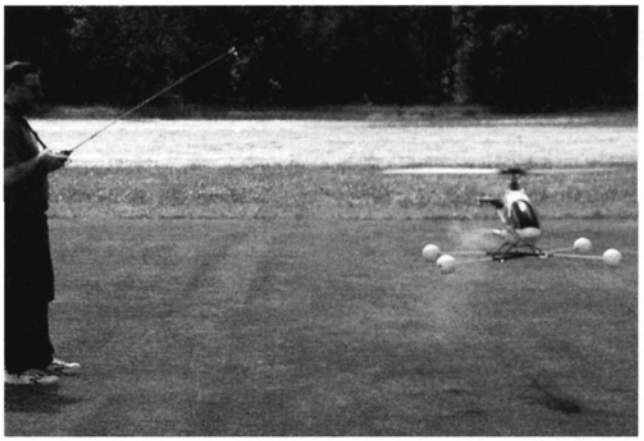
15 You can use any kind of dope, filler, or paint to smooth and finish the fillet. I don't overdo the finishing. I build models to please the air they fly through, not to please the eye of the beholder. TAM-10 is a special, 81-inch-span bird I use to test fuel consumption. The real transatlantic models will be similar in size and shape but will have ailerons.



You can learn more about this transatlantic project by joining STAR—the Society for Technical Aeromodel Research. Write to the society c/o John Patton, 2001 Norvale Rd., Silver Spring, MD 20906 for its charter and goals.

**Addresses are listed alphabetically in "Featured Manufacturers" on page 142.* ✈

Mastering nose-in hovering



Left: learning nose-in hovering from the ground up requires a lot of concentration but is less risky for the heli if you make a mistake. Right: learning nose-in from a 90-degree hover requires you to hover from different orientations. Slowly yaw the heli toward you in small steps until the nose of the heli is facing you.

In previous issues, we've discussed the basics of hovering and forward flight, and you have at last reached the point where you have mastered the tail-in hover. You are beginning to feel "one with the machine," but you are also aware that this togetherness can literally turn around on you. You're not quite one with the machine yet. It is no secret that to become a proficient heli pilot, you must learn nose-in hovering. Descents out of forward flight, pirouettes and autorotations all require nose-in skills. If you are a proficient fixed-wing pilot, then you understand how a plane reacts to stick inputs when it's flying toward you, and you will have an advantage learning nose-in heli flying; this advantage, however, applies to forward flight only. During nose-in hovering, three of the controls seem reversed, but of course, the controls are still the same to the heli. No matter what your orientation is, left is still left to the heli. The confusion comes from the fact that you have been practicing very hard to hover the heli from behind, where control inputs match the reaction of the heli. So the question becomes, "*When* and *how* do I learn nose-in hovering?" The first part of the question is easy to answer: as soon as you can comfortably hover tail-in. The second part of the question is more difficult, as there are various ways to learn nose-in hovering: starting from the ground up; starting from a 90-degree hover; and starting from forward flight. Each has its advantages and disadvantages, and I'll describe them, beginning with the way I learned myself.

FROM THE GROUND UP

This is just like learning to hover tail-in all over again. You'll have to pull out that training gear you thought you wouldn't need anymore. Strap it back on, and remember how you learned to hover tail-in. You started by getting the heli light on the training gear and exercising the cyclic controls and the tail rotor. This will be no different. The process is the same, except you start by looking at the nose of the heli. Begin by facing the nose of the heli into any wind. Actually, a little wind is good, as it will help stabilize the tail. Stand at least 20 feet back from the nose (for safety), and slowly feed in throttle until the heli starts to get light on its skids. Now play with the controls, and note the reactions. As you move the roll cyclic to the right, the rotor disc tilts to your left, and a left cyclic command tilts the rotor disc to your right. Now move the cyclic fore and aft. A forward command tilts the rotor disc toward you. Unnerving, isn't it? You have to learn to look at the heli in new ways.

First, consider the tail rotor. You could fly the tail rotor as if it were the nose; the tail-rotor pitch will now respond as if the heli were hovering tail-in; e.g., a right-stick command will move the heli's tail to the right. By "reversing" your concept of the heli, you've made pitch control familiar once again. An even better method is to think of the whole heli as rotating either clockwise or counterclockwise. No matter which way you look at the heli, a right tail-rotor command rotates the heli clockwise—it doesn't matter whether it's nose-in or tail-in (Figure 1). Once you've mastered nose-in pitch control, it's time to consider the cyclic. The key idea with cyclic control is to use counter commands. If the heli starts to drift, for example, to the *right* (your right), push the roll cyclic to the *right*. In reality, the heli is moving to its *left* and you've just given a *right* command to counter the drift (see Figure 2). Simple, isn't it? The same goes for the forward/aft cyclic. If the heli moves *toward* you, pull the cyclic *toward* you. Again, you're giving a counter command to stop the movement. In other words, move the control stick in the same direction the heli is moving to check its motion. Once you have a feel for the controls, increase throttle until the heli is a few inches off the ground. Remember that the lack of altitude is your friend. Briefly hold the hover and land. Keep extending the time your heli is airborne until you can hover out a full tank, just as you did for tail-in hovering. Your learning curve should be shorter this time because you already have hovering skills.

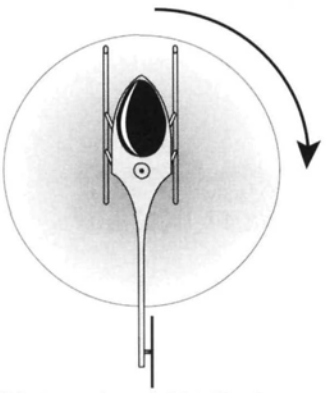
STARTING FROM A 90-DEGREE HOVER

Begin by hovering the model at a 90-degree angle to yourself so you're looking at the heli's side. You should be able to do this

Left: starting nose-in hovering from forward flight is the least risky to the heli but requires you to be able to fly around. Starting from 20 to 30 feet high leaves lots of room for mistakes. Right: end result—a rock-steady hover at eye level!

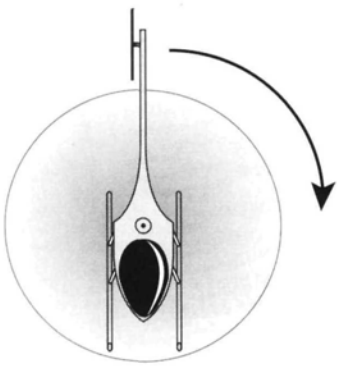
fairly well by now. Again, be sure to keep a reasonable distance between you and the heli. Now apply tail rotor to turn the nose of the heli toward you (10 or 15 degrees should be enough to make you nervous). Try to hold the heli in this position until it becomes easier to do. When it has, add another 10 to 15 degrees of movement so the nose of the heli is pointing more toward you. Practice holding this position until you feel comfortable, then rotate the heli a few more degrees and hold. Keep rotating the heli toward you in small increments until the nose is fully facing you. This is an easy way to become experienced with the reversed controls. Be sure that once you can turn the heli toward yourself from one direction, you also practice turning the heli toward you from the other side. In other words, if you first learn by looking at the right side of the heli, try learning the maneuver from a position where you begin by looking at the left side of the heli. Another variation is to start from the ground up using training gear.

Figure 1. Pitch control



Tail-in hovering: right tail-rotor command yaws the heli clockwise.

Nose-in hovering: right tail-rotor command yaws the heli clockwise.

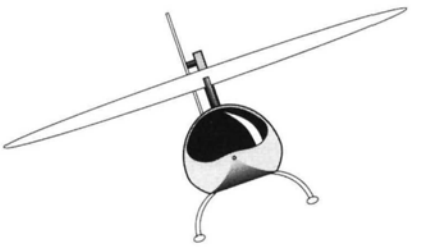


STARTING FROM FORWARD FLIGHT

If you can fly circuits, this is a good method for learning nose-in because you'll have some altitude on your side in case you make a mistake. Start by flying around a bit to loosen up. As you approach yourself, slowly bring the heli into a brief hover, 20 to 30 feet up and about 30 feet in front of you. Hold this for a few moments then add power and fly away from yourself. Go around in another circuit and repeat the process, but hold the hover a little longer this time. Soon you'll be able to hold the hover quite easily. Once you've reached this stage, start lowering the hover in small steps until you can hover the heli at normal hover altitude in front of you. Once you can hover nose-in, try pirouetting (from both directions) from nose-in to tail-in. Be sure to mentally turn your brain from nose-in to tail-in; failure to do so can lead to confusion and possible disaster. Train yourself thoroughly; don't give "backward" commands.

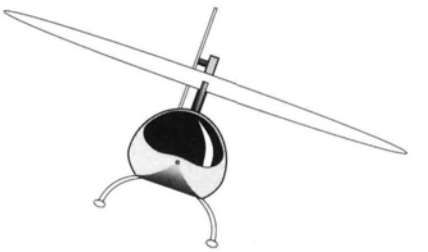
Figure 2. Cyclic control

Left side of rotor disc is low (helicopter tilts right).

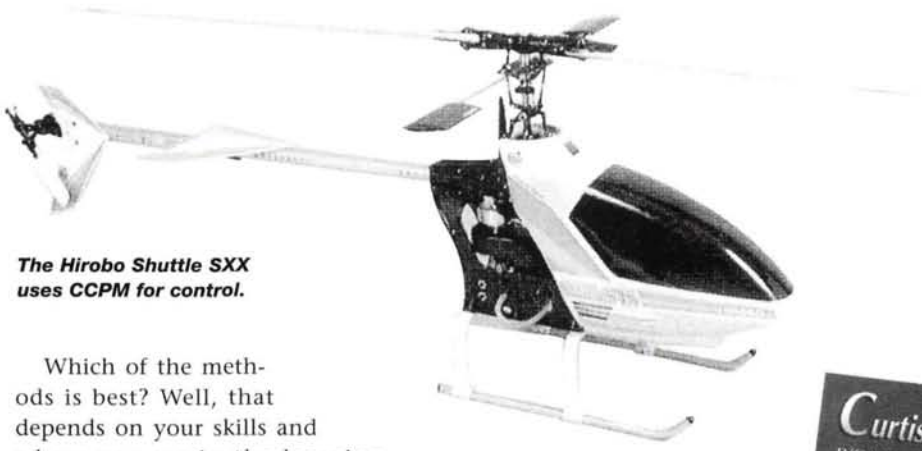


Correction: apply left cyclic to the low side of the disc.

Right side of helicopter is low (helicopter tilts left).



Correction: apply right cyclic to the low side of the disc.

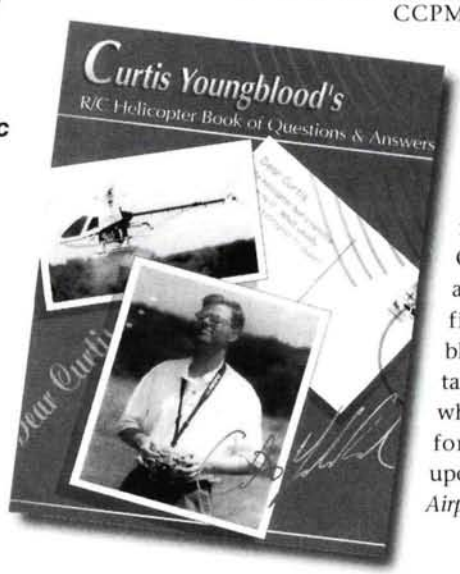


The Hirobo Shuttle SXX uses CCPM for control.

Which of the methods is best? Well, that depends on your skills and where you are in the learning process. Obviously, if you can't fly circuits, then starting from the ground up is the way to go. The real key to learning nose-in hovering is to practice, practice and practice some more.

NEW PRODUCTS

I recently got my hands on a long-awaited book called "Curtis Youngblood's R/C Helicopter Book of Questions & Answers." It's not your typical "start at page one and read until you've finished"; instead, the book is written in a question-and-answer format that answers heli pilots' most commonly asked questions. I found this style refreshing and easy to use. If you have a question about radio or heli setup, just look up the question in the index and go to the referenced page; there's the answer you need. Neat! The book covers just about anything you ever wanted to know from the master of helicopters.



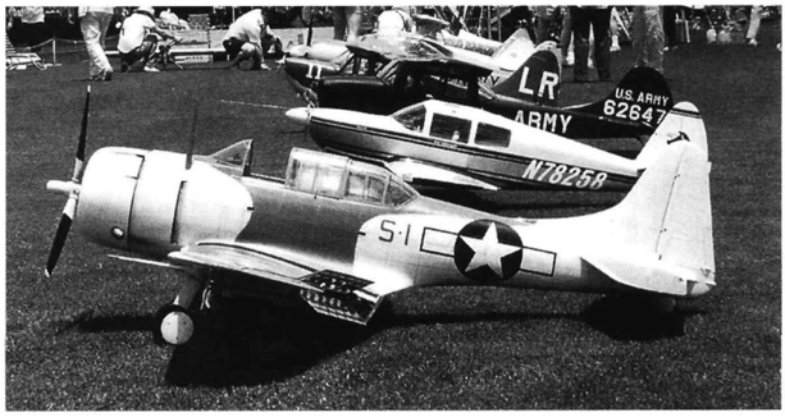
"Curtis Youngblood's R/C Helicopter Book of Questions & Answers" is a complete guide to the world of RC helicopter flying. Selecting, building and setting up a heli, beginning flying and advanced aerobatics are all presented in a question-and-answer format that makes it fast and easy to find the information you need.

Also new is the next generation of venerable Hirobo Shuttles known as the Shuttle SXX. This seventh-generation Shuttle uses CCPM (cyclic/collective pitch mixing) for control and is built in traditional Shuttle fashion. The manual is very thorough and gives many diagrams for the various setups. Other features include a metal swashplate, finished main rotor blades, RG Shuttle-style tail fins and precovered white tail boom. Watch for a full review in an upcoming issue of *Model Airplane News*!

Balance that big bird!

If you want to be successful when you test-fly a new model, remember three basic things: make sure the engine runs properly, check that the radio works correctly, and be *absolutely* certain that the model is balanced at the correct center of gravity (CG)! Nothing spoils your day at the flying field more than trying to sort out a tail-heavy model. I'd be willing to bet that the CG (or at least the wrong CG) is responsible for more broken airplanes than the other two points mentioned above put together. Let's take a look at the method of balancing and determining the CG.

All models have one thing in common: they fly poorly if they aren't balanced properly. Proper CG is perhaps the most important consideration when you fly a new model.



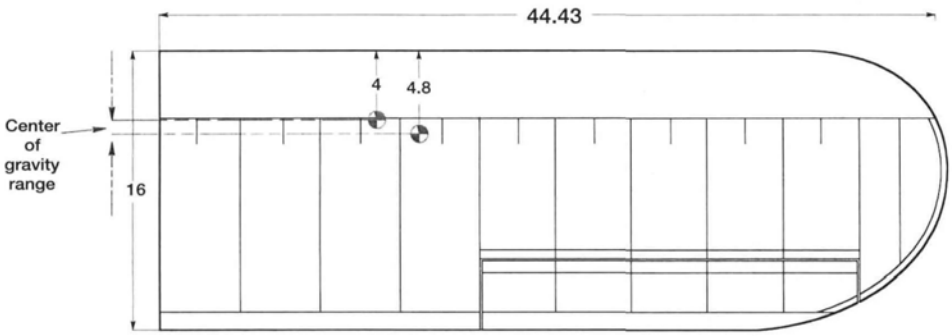


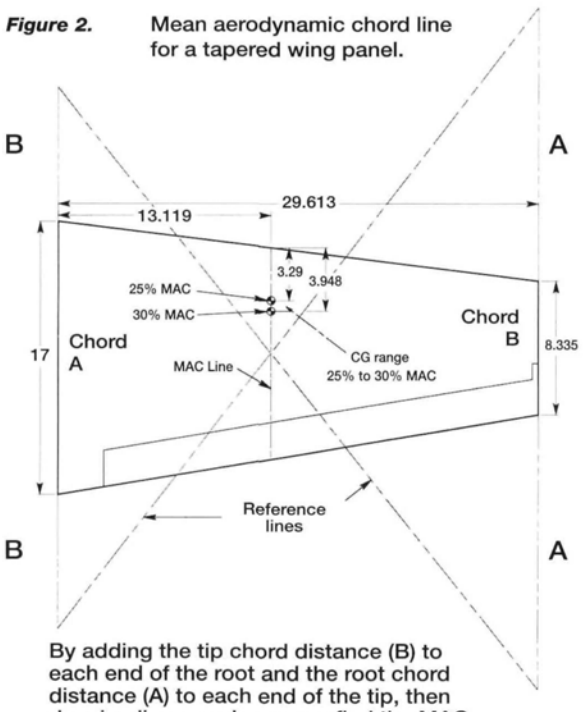
Figure 1. Typical constant-chord wing should be balanced somewhere between the 25-percent and the 30-percent chord length range.

First, I qualify my statements by saying that these are good estimations that will get your model balanced "in the ballpark" and within acceptable CG ranges making it safe to fly. I do not take into account lifting tail surfaces or other unusual configurations. For more detailed, aerodynamic principles, check out Andy Lennon's book, "RC Model Aircraft Design," listed in the "Pilots' Mart" section.

When you balance your model, use the location indicated on your model's plans along the wing's mean aerodynamic chord (MAC) line. If you don't have this information, you will have to figure it out yourself. On *most* models, the balance point falls between 25 and 30 percent of the MAC; 27 to 28 percent seems to be the average. On a constant chord wing, such as on a Piper Cub, the MAC line is the wing's chord line. On a tapered or swept wing, you must determine the MAC line position (see Figures 1 and 2).

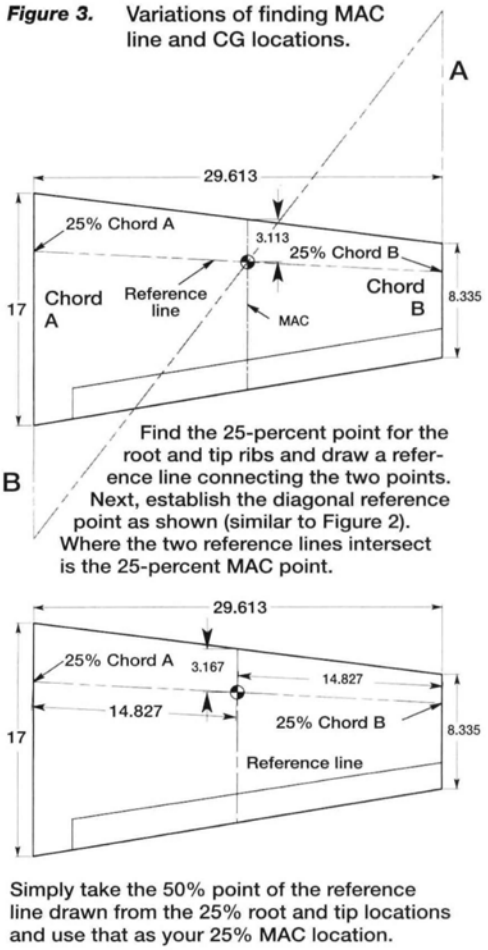
Figure 3 shows two common variations of finding the MAC line for tapered wing panels. The important thing here is to get

Figure 2. Mean aerodynamic chord line for a tapered wing panel.



By adding the tip chord distance (B) to each end of the root and the root chord distance (A) to each end of the tip, then drawing lines as shown, we find the MAC at the intersection of the reference lines.

Figure 3. Variations of finding MAC line and CG locations.



Find the 25-percent point for the root and tip ribs and draw a reference line connecting the two points. Next, establish the diagonal reference point as shown (similar to Figure 2). Where the two reference lines intersect is the 25-percent MAC point.

Simply take the 50% point of the reference line drawn from the 25% root and tip locations and use that as your 25% MAC location.

Astro Flight News

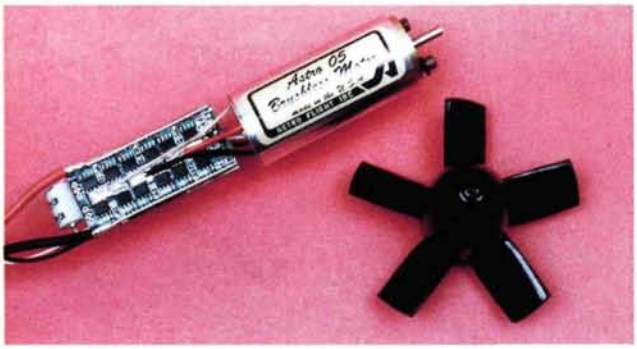
Astro Flight Inc. Introduces five new and exciting products for the electric flyer: The new Mighty Micro 010 Brushless Motor for park flyers, a new Ducted Fan Brushless 05 Motor for the Kyosho T-33, FAI-035 and FAI-05 Planetary Motors for Sailplanes and two new surface mount digital speed controls.

The Mighty Micro is here!

Our new Mighty Micro Brushless 010 Motor #801 has arrived. The motor is one inch in diameter and one inch long and weighs only 35 grams with sensorless control. It spins an APC 6x2.8 prop at 9800 RPM while drawing only 2.5 amps from a six cell 350 mahr Nicad pack. Now you can fly for 5 minutes on Nicads, 10 minutes on Hydrides and one hour on lithium cells. The tiny On-Off Brushless control has Brakes and BEC. This system will work with 5 to 8 cell batteries. Perfect for models up to 10 oz.

New Ducted Fan 05 Motor!

Our new 4 turn Brushless 05 Ducted Fan Motor #805F with 12 FET controller is specially designed to add Afterburner performance to the Kyosho T-33 and WE-Mo-Tek 480 ducted fan units. Run the T-33 fan on 8 or 9 Nicads or 10 Sanyo 3000 mahr Hydrides. The motor draws only 19 amps for 10 minute flights on Hydrides.

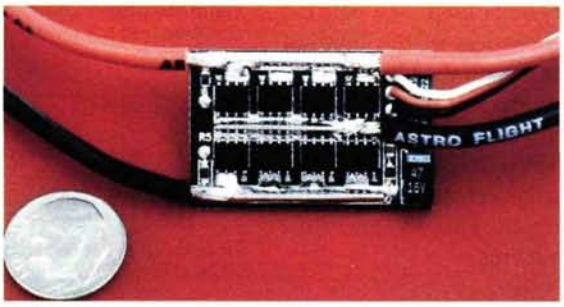


FAI-035 with Planetary Gearbox

Our new 4.4:1 planetary gear box is now available for all Astro Cobalt 035, 05 and 15 motors. The FAI-035 with planetary gear box is perfect for 7 cell competition sailplanes. The FAI-05 with planetary gear box, shown here, is perfect for 10 cell sailplanes.

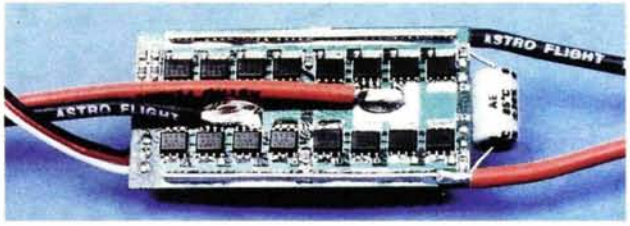
New Astro 215D Airplane Control

The new Astro 215D Speed control uses new surface mount technology for minimum size and maximum performance. The tiny 215D weighs only 8 grams and has Brakes and BEC. It handles up to 30 amps and 10 cells. Perfect for Astro Cobalt 035, 05 and 15 motors.



New 208D Reversing Control

The new 208D Reversing Control is designed for scale boats. It's 16 FET H-Bridge circuit gives you full power forward and reverse. The 208D weighs 1 oz and can handle 25 amps at 6 to 12 volts. It has a 2 amp BEC and a electronic current limit of 28 amps, so no fuses are needed. It was designed for tug boats and works great with 150 pound robots and electric powered blimps.



Astro Flight Inc. 13311 Beach Ave. Marina Del Rey, CA 90292
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the balance point somewhere in the CG range of 25 to 30 percent of the MAC. Once this has been done, your model might still be slightly nose- or tail-heavy, but at least you know it will act normally once it leaves the ground. From here, by the way it flies, you can let the model tell you what's needed to fine-tune the balance. Please note that by using three methods of finding the MAC and CG in Figures 2 and 3, the 25-percent MAC locations differ by only 0.177 inches, or roughly less than 3⁄16 inch. My point is that regardless of the method you use to find the MAC and the balance point, it will be roughly in the correct place well within acceptable limits—like using three equations to come up with roughly the same value. Now let's go flying!

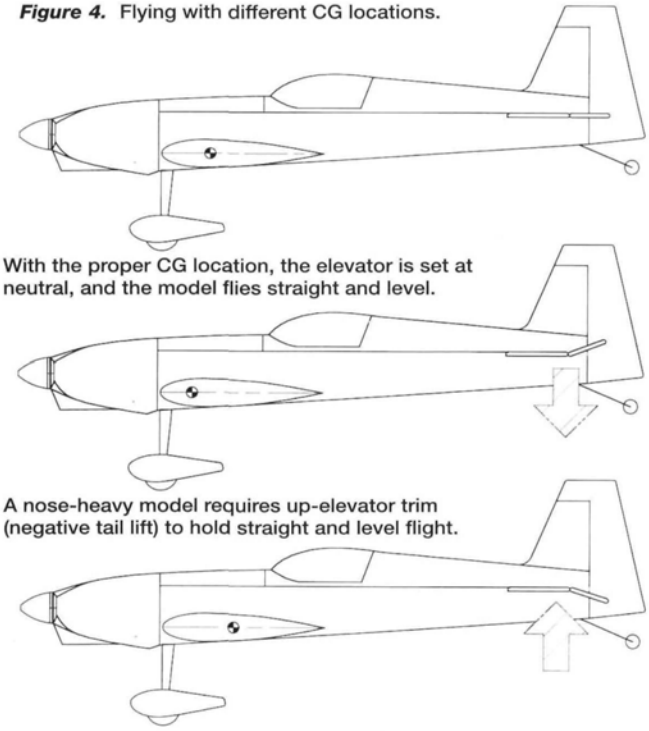
The tried and true Piper Cub is a good example of a model with a constant chord wing. Balance it anywhere along the panel, and you'll get it right on the MAC.

Left: for a tapered wing panel, finding the MAC takes a little calculation. But make sure you get it right. Right: big models, especially multi-engine bombers, appeal to modelers. Balancing them correctly is a good way to protect your investment.

FLYING THE CG

With our CG in the safe balance range, we can take off and sort things out on the first nerve-racking flight. Fly the model at about ¾ throttle, and set the trims for straight and level flight. After landing and checking the trim-lever locations, typically we adjust the clevises so we can return the trims to neutral and have the model fly normally, not climb or dive with application of power. Take a closer look at elevator trim. Is there a lot of added up- or down-trim? This is a good CG indicator. A lot of up-trim tells you that the CG is too far forward (nose-heavy); a lot of down-trim indicates an aft CG (tail-heavy). Shifting the battery forward or adding some nose weight fixes the tail-heavy condition.

Figure 4. Flying with different CG locations.



BIG BALANCER

Large and giant-size airplanes are at best difficult to balance; that is to say, you can't just pick them up, hold them under the wing with your fingertips and eyeball the situation. You need a good, solidly built balance fixture that will pin-

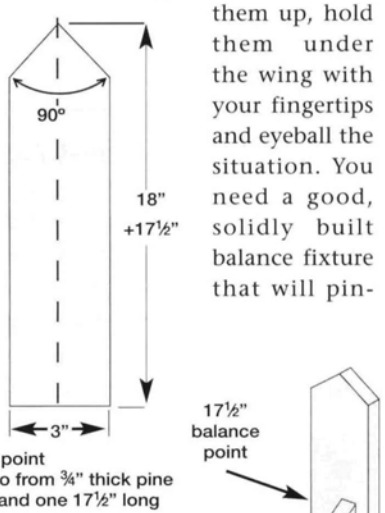


Figure 5. Building a balancer.

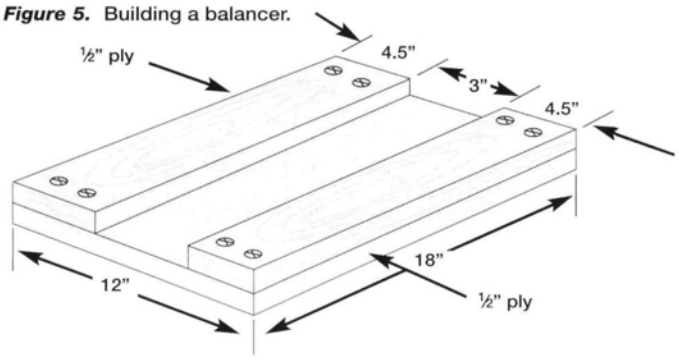
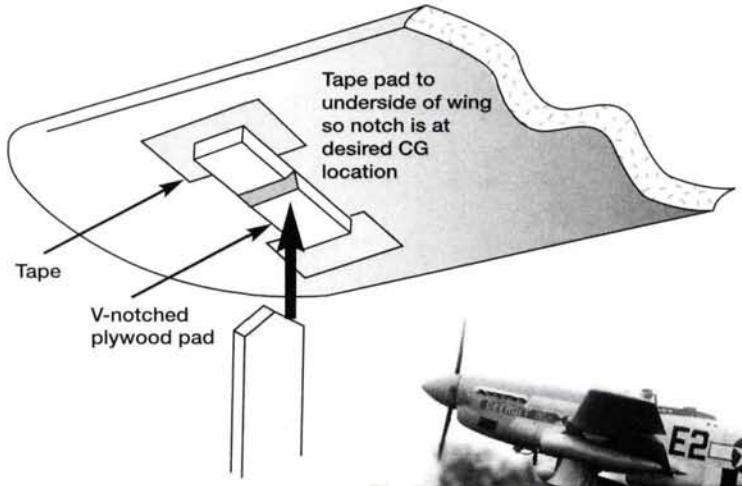


Figure 6. Preparing the wing before balancing.

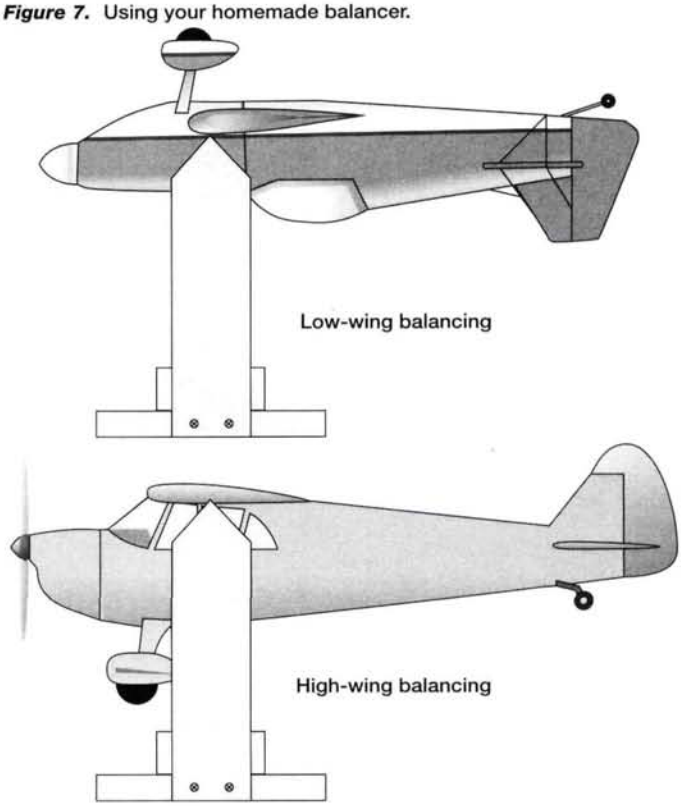


Warbirds especially need to be balanced correctly. Trying to sort out a tail-heavy fighter is like swimming up river; sooner or later, you lose!

point the model's CG and not damage the wing in the process.

Figures 5, 6 and 7 show what I use to balance my big birds. To make a balancer, I use ¾-inch pine boards and some plywood. The fixture is nothing more than two pointed upright boards supported by a plywood base that's large enough to safely support the model. I custom-make the balancer to accommodate whatever type of model I build. Sheetrock screws hold the balancer together, and the entire building job takes about 2 or 3 hours.

Figure 7. Using your homemade balancer.



The secret of using this type of balancer without damaging your model's wing is to use two thin plywood pads (one under each panel) with a V-notch cut into them. I measure the position of the CG and mark it on the wing. I then tape the two plywood pads into place while aligning the V-notch with the marks. I then place the plane on the pointed vertical boards (placing the pointed ends of the boards into the notches) and balance the plane.

One-sixteenth-inch plywood pads are good for models of up to 10 pounds, and for heavier ones, I use 3⁄32- or ⅛-inch plywood. Make the pads about 2 inches wide by 4 inches long, and use masking tape to secure them in place. This balancer works really well, but help from a friend makes the job easier and safer for the model.

The best insurance policy for your model is to have it as close as possible to the correct CG before flying. "Feeling" what the model tells you when it is flying helps to fine-tune its balance. Some basic calculations before that first flight will help keep your model whole. No amount of math after a model is broken will repair it. ✈

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CLASSIC ROUND ENGINE AIRPLANE PLANS; 1"=1' scale; large display models (not giant). 3 sheets detailed plans, 24x36". Full-size templates. Cessna 195, Beech Staggerwing, Stinson Reliant, Waco Cabin, Howard DGA, Fairchild 24. $30 each. T&D Plan Sales, Box 6765, Los Osos, CA 93412. [9/00]

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Congratulations to Willis H. Yule of Owatonna, MN, for correctly naming our July 2000 mystery plane: the Chance-Vought F7U-3. Willis worked on the F7U-3 "Cutlass" back in the mid-50s while he was stationed in Oceana, VA. The Cutlass has the distinction of being the first production Navy aircraft to achieve supersonic flight, first to release bombs while traveling faster than the speed of sound, first to incorporate afterburners, power controls and automatic stabilization, and the first to catapult from a carrier deck with more than 5,000 pounds of external stores. The F7U-3 carried a standard armament of four 20mm cannon and an underslung "Mighty Mouse" missile pod. For strike missions, two more pods could be placed beneath the wing's hard-points. ◀

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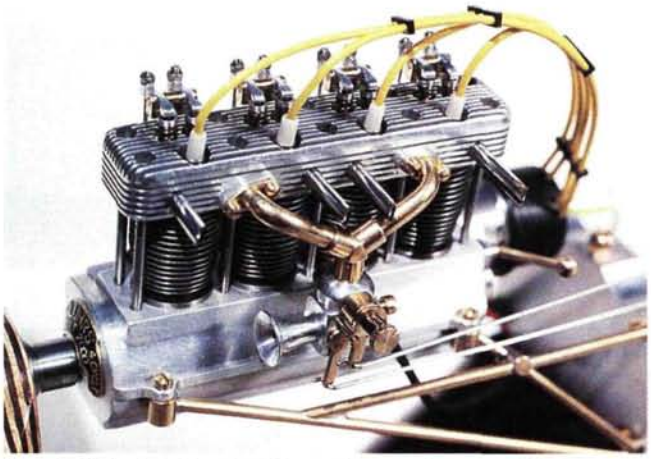
Advertisers

Miniature 4-cylinder 4-stroke

George's engine displayed with its components. If the whole is greater than the sum of its parts, just consider the work that went into each of those parts!

Designed and built by George Luhrs of Shoreham, NY, this mechanical masterpiece is a precise miniature of a gas-ignition model airplane engine of the 1930s. It represents 600 hours of design and very fine machine work. The overall length of the crankcase is 1⅞ inches; in comparison, a pack of gum is 3 inches long.

George has been building engines of all sizes for most of his life, and he has a large collection of restored, WW II-era machine shop tools. He made many of the 230 parts of this particular engine on a fairly large, 13-inch lathe, using homemade fixtures and tools unique to this project. Other parts for the engine were made using a much smaller watchmaker's lathe.



It isn't difficult to imagine the engine running smoothly, the rocker springing back and forth and tiny bursts of exhaust shooting from the stacks and into the propwash. (Shown approximately full size.)

The engine's updraft carburetor has a choke and a needle valve for setting the mixture. The throttle control automatically changes the fuel mix from low to high speed, and ignition is controlled with a spark-and-advance lever. The spark plugs are made of tool steel with Macor insulators. The thread is no. 2-64 (0.086-inch diameter). The distributor is made of Delrin and has tungsten contact points that are swept by a Teflon rotor.

The crankcase, cylinder head, distributor housing, carburetor body and all other aluminum parts are made of high-strength 7075-T7 alloy. The no. 00-90 thread cylinder-head bolts, pushrods, valves and exhaust stacks are all made of stainless steel, and the crankshaft, bearings, valve tappets and guides, and all other parts such as the camshaft, pistons, wristpins, connecting rods and cylinders are all made of hardened tool steel. Think about machining a camshaft and cutting cam lobes on a steel shaft that's smaller than a wooden matchstick! George notes that the most difficult part of building this engine was creating a tiny carburetor that could meter extremely small amounts of fuel.

The engineering is inspirational! Is anyone out there interested in building a matching airframe?

SPECIFICATIONS

Type: 4-cylinder, 4-stroke gas ignition
Crankcase: 1⅞ in.
Piston: ¼ in.
Stroke: 5⁄16 in.
Displacement: 0.061ci
Fuel: white gas with 50:1 Marvel Mystery oil

The engine runs on white gas with a 50:1 mix of Marvel Mystery oil for lubrication, and George and a friend are now testing its reliability to see whether they can safely use it to fly an RC model.

This past April, George's subminiature engine was awarded first prize at the national North American Model Engineers Expo in Detroit.

What's next for George? Perhaps an engine that's half the size of this one: he is now working on a small powerplant that has an ⅛-inch-diameter piston! ✈